Pit and Quarry
SAND • GRAVEL • STONE
HANDLING • CRUSHING • SCREENING • WASHING

Why The Superior Portland Cement Co. Replaced "Coyote Holing" With Big Blast Hole Drilling

THE Superior Portland Cement Company of Concrete, Washington, whose plant is described in this issue, have a typical West Coast mountainside quarry. The face is high, now ranging from 150 to 250 feet and it will increase in height rapidly due to the steep slope of the hill which makes the quarry top. The face is approximately 1100 feet long and the required capacity of the quarry is 2000 tons per eight hour day. The limestone formation is hard and full of pockets and seams. The stratification is somewhat irregular, dipping for the most part, towards the quarry face.

The coyote hole or tunnel method of blasting as used for a number of years was unsatisfactory for the following reasons: High primary explosive costs; the difficulty in reaching the top of the face with explosive action, causing huge blocks of stone to be set out that required bull dozing and resulting in delay and danger to both men and shovels; the danger of rock slides and the uneven quarry floor.

The company realized the economies of well drill or big blast hole drill operation but were hesitant in trying the system because of the one time failure of a well drill to put holes down through the seamy rock.

In January, 1925, a Cyclone No. 14 Super Electric Traction Drill was placed in the quarry on a basis of guaranteed results. In May a second machine was purchased. These drills are equipped with 8 inch bits and 5 inch by 20 foot drill stems—a tool equipment weighing nearly a ton. The company reports that although the drills have been working under adverse conditions due to back breaks from previous tunnel shots, they have not failed in a single instance to put the holes down the required depth.

Write for our 120-page book, "Big Blast Hole Drills"

The Sanderson-Cyclone Drill Co., Orrville, Ohio

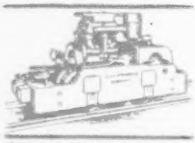
September 15, 1925

Index to Advertisers.....Page 39
Table of Contents.....Page 41

Circulation 7,600

U. S. Gypsum Uses "Whitcombs"

"Whitcombs" insure dependable service for hauling, switching and interplant transportation. Built by those who made the first successful gasoline locomotive 19 years ago, they have behind them all those years of experience, which are necessary to the perfection and successful operation of such a highly specialized product.



The FIRST SUCCESSFUL GASOLINE LOCOMOTIVE WAS BUILT IN 1906 IT WAS A "WHITCOMB"

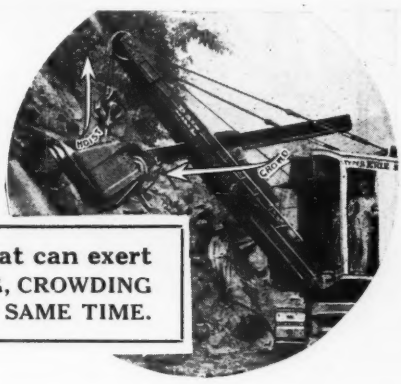
They operate equally well on permanent or temporary track, on a level or on grades up to 10% or 11%, require no operating crew (one man, experience unnecessary, can run them); require a minimum of fuel and practically no maintenance expense.

Speed up your production, increase your hauling capacity, lower your hauling costs—use a "Whitcomb."

GEO. D. WHITCOMB COMPANY
ROCHELLE, ILLINOIS
Offices in principal cities

GASOLINE-STORAGE BATTERY-ELECTRIC
WHITCOMB
LOCOMOTIVES

Load More Rock every day



With the ERIE— the shovel that can exert THE FULL POWER OF ITS HOISTING, CROWDING AND SWINGING ENGINES AT THE SAME TIME.

When the dipper tugs at a stubborn ledge of rock, the operator leaves the ERIE's hoisting throttle wide open— full steam on the hoisting pull—

While he works the crowding lever back and forth, prying the rock loose by moving the dipper in and out while pulling up, *and also swings the shovel slightly from right to left, to pry sideways.*

It is easy to see how much the ERIE's digging power would be cut down if the "crowd" and "swing" were driven (through friction clutches) by the same engine that was *already forced beyond its maximum load* to meet the demands of the hoisting pull.

Most quarrymen want to have plenty of *speed* on tap for rush orders. That's one reason why you see far more ERIES than any other shovel in the 20-ton class.

The reliable ERIE is your best insurance against lost time

Breakdowns are almost unknown with an ERIE— the most highly developed power shovel ever built. (Far more ERIES in service than any other shovel of one size and type.)

Actual records, kept by hundreds of owners, show that ERIES cost only ⅓ as much for upkeep and MAKE A CORRESPONDING SAVING IN WORKING TIME.

Even in the hardest rock excavation, the ERIE'S dipper teeth get the full power of the engines without a smashing jar. No need to bang into a rock in order to hold fly-wheel momentum— the steam's expansive force comes smoothly, giving the dipper a valuable "cushion" against sudden shocks. Protects the entire mechanism.

ERIE STEAM SHOVEL CO.

Erie, Pa., U. S. A.

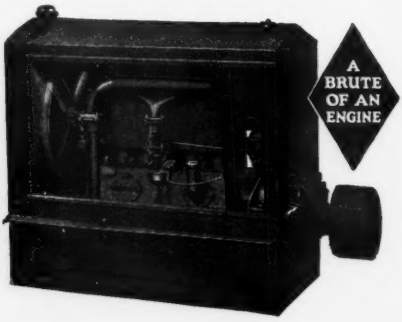
Builders of ERIE Shovels, Cranes, Ditchers, Draglines, Trench Hoes, etc.

Branch Offices:
Boston New York
Philadelphia
Atlanta Pittsburgh
Chicago

Representatives throughout the U. S. A.

ERIE Revolving Shovels

Beaver Power Unit contains a valve-in-the-head engine. It is protected by an all-steel housing which does not interfere with the accessibility of working parts.



All-Purpose Power Unit!

Crushers, loading and conveying machinery, hoists, conveyors, pumps, all heavy duty equipment require a power unit that can deliver steadily, without "time-out" for repairs.

Beaver Power Units are built to deliver power consistently, under severe conditions of service. All working parts of the Beaver Engine are of liberal size for ruggedness and strength, force-feed, fool-proof lubrication—every detail of the Beaver measures up to high engineering standards.

Write for pamphlet describing the Beaver Power Unit

BEAVER MANUFACTURING CO.

35 25th Street Milwaukee, Wis.

FOR STEADY SERVICE

Beaver

KOEHRING
Crane Excavator

GENERATIONS of experience—shop, field and engineering experience—are behind the men who build the Koehring!

The Koehring Company brought together that kind of men—and told them "build a better machine than has ever been built before."

No outworn traditions held them back, no big investment in old patterns and shop equipment were to be considered. Their experience was free to build right, without restriction!

That's one reason why the Koehring is designed in every gear and detail for internal combustion engine power—why the Koehring finger-tip control adds no mechanical complications.

In countless important factors, the Koehring *is* a better machine than ever built before.

Crane Capacities

No. 1—¾ cu. yd. clamshell bucket on 40 ft. boom, standard. Lifting capacity, 10 tons at 12 ft. radius. 4 cylinder, 5" x 6" gasoline engine. 1000 R.P.M.

No. 2—1 cu. yd. clamshell bucket on 45 ft. boom, standard. Lifting capacity, 15 tons at 12 ft. radius. 4 cylinder, 5¾" x 7" gasoline engine. 1000 R.P.M.

KOEHRING HEAVY DUTY

Write for Crane Excavator Bulletin No. Cr. 32

KOEHRING COMPANY

PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

MILWAUKEE, WISCONSIN

Sales Offices and Service Warehouses in principal cities

Foreign Dept., Room 1370, 50 Church St., N. Y.
Canada, Koehring Company of Canada, Ltd., 105 Front St., East, Toronto, Ontario.
Mexico, F. S. Lapum, Cinco de Mayo 21, Mexico, D. F.

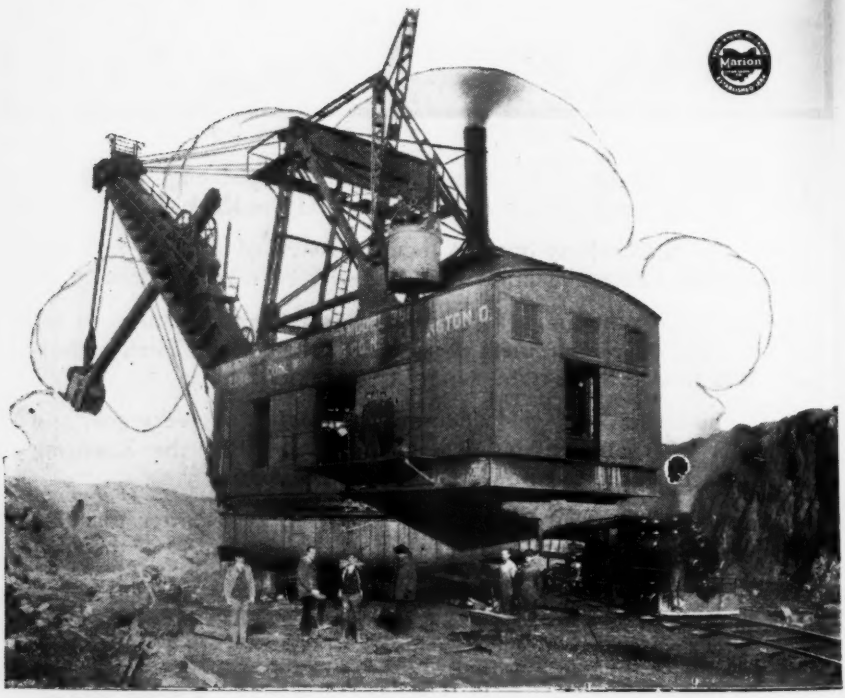
A 2687-III-IV

Where Clearance Counts

ON Marion Model 350 the 12-foot clearance between rotating frame and grade makes room for dinkey engine and cars to pass on the same level. A feature of special value in open cut mining and quarrying.

Get the details from the Marion engineering staff

The Marion Steam Shovel Company · Marion, Ohio



Model 350, equipped with 90-ft. boom and 56-ft. handle, can load into cars on top of a 56-ft. bank. To accomplish this same lift with the largest railway type shovel would require five or six benches.

Marion Power Shovels

2412

Designed to Dig

The Russell engineers have laid particular emphasis on points of design of the Massillon Steam Shovel, giving it strength, power and durability to dig at low costs. The shovel is made to be used with dragline or clamshell equipment and is well adapted for crane service. It can be furnished with crawler, traction or railroad traveling gear.

The Russell & Company have been in this field of manufacture for many years, which accounts for two great factors—the stability and dependability of the Massillon Shovel. Write for descriptive information and prices.

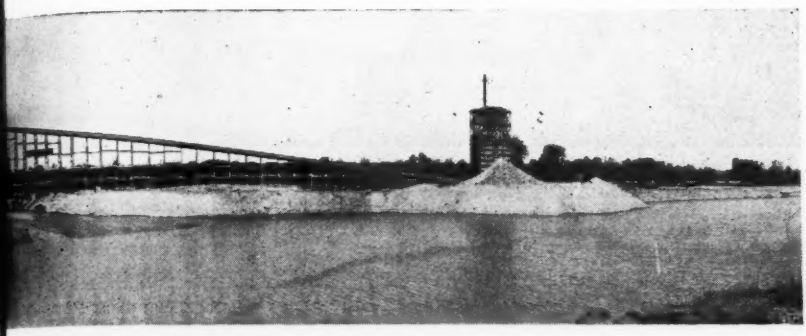
THE RUSSELL & CO.
MASSILLON, O.
(Established 1842)

The **MODERN MASSILLON**
Steam — 5/4 – 7/8 RANGE — **Shovel**

2,000 Feet of "U.S." Giant Conveyor Belting Gives Unusual Service

The panorama shows the big plant of the McGrath Sand and Gravel Company at Pekin, Illinois, with the double main conveyor which carries material from both banks up to the screens in the washing plant.

The belts used on this conveying system are "U. S." Giant Sand and Gravel Conveyor Belts, 24 inches wide by 7 ply, with 1/8 inch cover on carrying side and 1/32 inch cover on pulley side. We recently replaced one of these "U. S." Giant Belts, 1069 feet in length, with a new belt of the same specifications, after the old belt had run for five seasons.



"U.S." Giant Belt Serves for Five Years on Big Double Main Conveyor

There could be no better testimony to the value of equipment for sand and gravel plants than the endorsement of the McGrath Sand and Gravel Company, one of the largest operators in the industry. In their four plants of this type they are at present using about 6500 feet of "U. S." Giant Conveyor Belting.

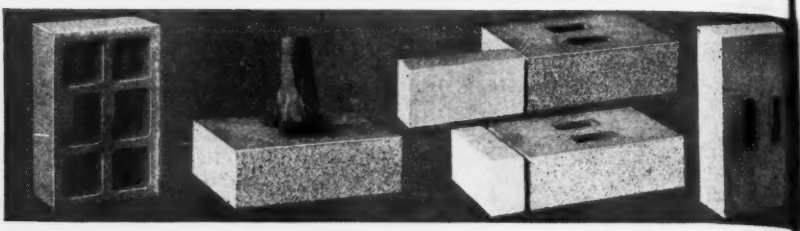
There is a "U. S." Conveyor Belt to meet every need of the Rock Products industries and "U. S." Conveyor Belts carry with them an assurance of maximum service and efficiency. When you are confronted with a conveyor problem, get in touch with our nearest branch where you can obtain the services of a conveyor engineer who will gladly help you on your belting problems.

United States Rubber Company

1790 Broadway New York City

Branches In Every Industrial Center

Trade Mark



The above illustration presents clearly the outstanding features of Shope Hollow Building Tile. Note the "one hand grip" and the proportions relative to Shope Brick.

The Last Word in Building Units

THE widespread interest aroused by the basic and epoch making invention of Shope Brick elicits the attention of Brick users and manufacturers to Shope Hollow Building Tile.

The Shope vertical sealed web, 4 x 8 x 12 hollow building tile is equal in width to the length of a Shope Brick, is as high as a Shope Brick laid on edge and is provided with a "one hand grip" for easy handling in buttering head joints and laying to a line. Its proportions make it possible to cut a brick instead of attempting to cut a tile for meeting all fractions of inches when bonding to openings. These features eliminate the necessity of carrying large stocks of fractional block or tile.

Shope Hollow Tile, when laid above grade for superstructure, may have any of the attractive waterproof and ornamental finishes of Shope Brick. Its weight is 12½ lbs. and each tile has a crushing strength of from 25 to 30 tons.

The use of Shope Hollow Tile reduces the cost of masonry walls 50% in labor and reduces the weight on footings 50%, yet it meets all safety requirements specified by the engineer. It is one way of "squeezing waste out of industry" as Secretary Hoover has put it. Mr. Hoover, in his address to the National Conference of the Chambers of Commerce, said that "simplified practice in doing away with excess, obsolete or undesirable styles, sizes, and varieties is the cutting loose of all 'deadwood' which by reason of practice, custom, or heritage has grown up around an industry."

Economy in Building Shope Hollow Tile Homes

CONSERVATIVELY estimated, there are 1,000,000 wooden houses built annually in the United States. These consume more than 15,000,000,000 feet of lumber, one-third of which, at least, is for outside walls. It would cost no more to build these walls with Shope Hollow Tile, and the actual investment value would be increased 25%. The production of these tile would use 20,000,000 yards of aggregate, much of which is now lost to aggregate producers. The improved fire-resisting construction would save at least one-half of our $600,000,000 annual fire loss. Then, there are the additional advantages of improved sanitary conditions and the saving of a large part of the 25,000 lives annually lost by fire.

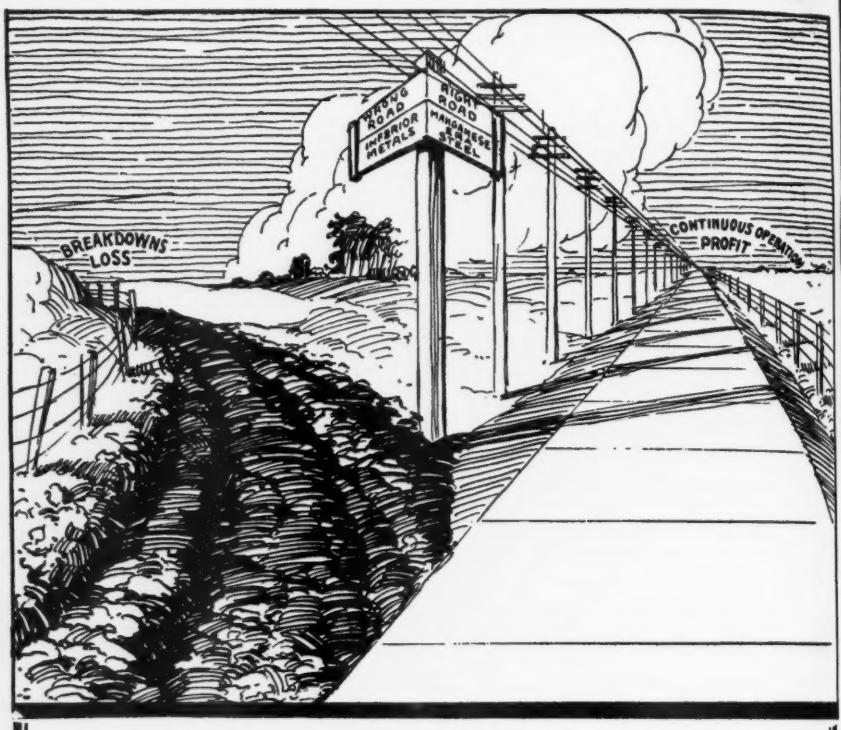
Lastly, use of Shope Hollow Tile would mean an important step toward the conservation of our forests, the wanton depletion of which is nothing short of a criminal neglect considering coming generations. At a recent convention in Washington, D. C., President Coolidge warned the country that at the present rate of consumption our forests would be depleted in forty years.

If the foregoing facts and considerations indicate to you a market for Shope Hollow Tile you will adopt Missouri's slogan, "Show Me." We'll be "Johnny on the Spot."

Full page advertisements in recent issues of The American Magazine and The Saturday Evening Post describe the development of Longview, Wash. This beautiful new city has the largest saw mills in the world and is rapidly gaining in manufacturing importance. Practically the entire city of Longview is built of Shope Brick.

SHOPE BRICK CO.

·COMMON BRICK· **PORTLAND, OREGON** ·FACE BRICK·



Are You On The Right Road?

Travel the road that insures you against loss of time. Save money by replacing your worn equipment with "ERA" Manganese Steel Parts.

The extreme shock resistant quality due to its ductility, plus the power of resistance to abrasion accounts for the long, dependable service of "ERA" Manganese Steel Castings.

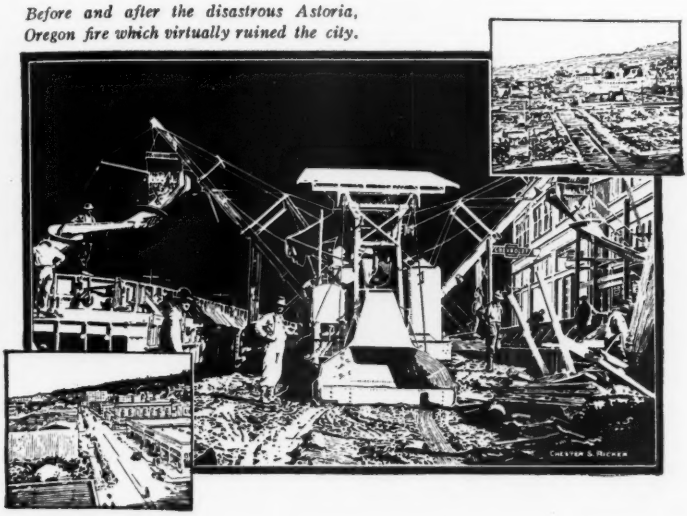
Follow the direction that leads only to continuous operation, economy and greater production.

Write for the information you want

HADFIELD-PENFIELD STEEL CO.
Bucyrus, Ohio

MANGANESE STEEL
ERA
THE FIRST - STILL LEADS IN QUALITY

Before and after the disastrous Astoria, Oregon fire which virtually ruined the city.



WAUKESHA MOTORS helping to REBUILD A CITY

In Astoria, Oregon, a ruinous $11,000,000 fire laid flat 32 city blocks. Out of the ruins a new city has been builded. One of many world's records made here by Waukesha Industrial Power Units was in Exchange Street where 1440 square yards of concrete 7″ thick by 36′ wide (together with 600′ of monolithic curb) were laid in 9½ hours. John Slotte & Company made this record with a Waukesha powered Rex 21E Concrete Road Builder.

Write for Waukesha Book of Industria Power Units. These units, in sizes from 15 to 100 H. P., are available for all purposes.

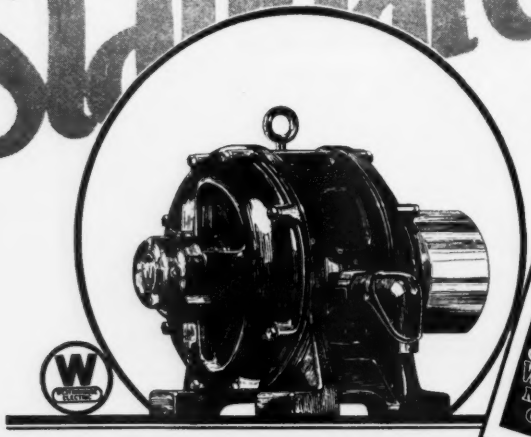
WAUKESHA MOTOR COMPANY

Waukesha, Wisconsin

New York City	Hartford	Kansas City	Denver	Tulsa	Houston
Aeolian Building	*K. B. Noble Co.*	*V. L. Phillips Co.*	*Western Equip. Co.*	*C. F. Camp Co.*	*Portable Rotary Rig Co.*

Exclusive Builders of Heavy Duty Gasoline Engines for Nearly Twenty Years

Standardize



Outfitting an army would be a more formidable task if each soldier's uniform and accoutrements had to be specially designed. First costs, and renewals, too, would be enormously expensive—hence standardization.

WESTINGHOUSE is furnishing the industrial army with standard motors to fit every machine and is saving worth-while amounts in first cost because it is not necessary to pay for special design.

Maintenance costs are reduced, too, because attendants having familiarity with various makes of special motors are not required.

Few renewal parts need be carried—one size of bearing will fit quite a number of Westinghouse motors, and other wearing parts are interchangeable, also.

Get these benefits of standardization on the profit side of your ledger by specifying Westinghouse motors and control for every driven machine.

Westinghouse Motors are applicable to the following rock products equipment:

Conveyors

Hoists

Pumps

Crushers

Shovels

Kilns

Compressors

Specify Westinghouse and make Westinghouse Motors and Control *your* standard.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of
the United States and Foreign Countries

Westinghouse

X 82980

MEAD-MORRISON HOISTS

Rock of Ages granite being lifted by Mead-Morrison 3-Drum Hoist. Boutwell, Milne & Varnum Co., Montpelier, Vt.

If your hoist requirements call for safety, power and economy you can find what you want in the Mead-Morrison line.

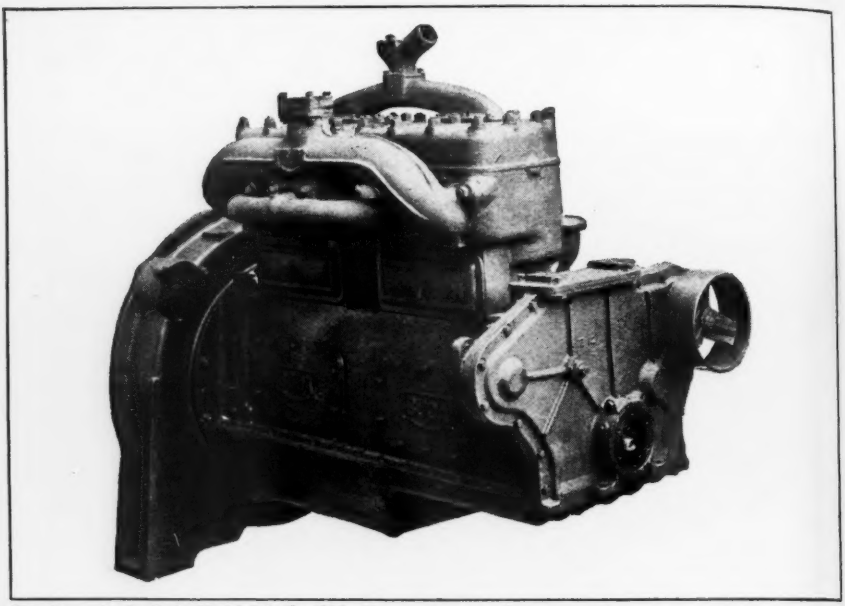
Write for Catolog No. 24

MEAD-MORRISON
MANUFACTURING COMPANY

928 Prescott Street East Boston, Mass.

Welland, Canada

Branch Offices: New York, Chicago, Montreal



New four-cylinder Buda Model JH, 6" x 7⅛". Note construction of rear mounting

Announcing

The latest and most powerful Buda *Model JH*

In line with the Buda policy of "an engine for every industrial need," The Buda Company announces the latest addition to its fleet of giant engines—the four cylinder Model JH.

With a bore of 6 inches and a stroke of 7⅛, this engine develops amazing power—power that makes for the most economical and satisfactory handling of one-yard shovels, 12-ton cranes, extra large air compressors, hoists, drag lines, dredges and similar equipment.

Wherever exceptional power and absolute dependability are required, Model JH is the engine for the job. Send for booklet and complete information regarding this new model, which is now in quantity production and ready for immediate delivery.

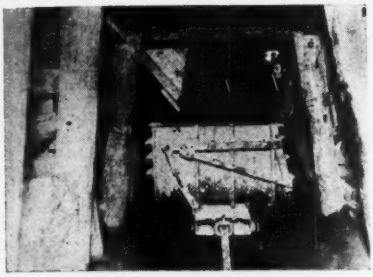
THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILL.
ESTABLISHED 1881

Buy only genuine Buda Parts for your Buda engine

BUDA
The
ENGINE

Koppel Cars on the Pacific Coast

Inspiration Copper Co., Colorado



Consolidated Copper Mines Corp., Nevada

United Verde Copper Co., Arizona

That the western engineer and contractor knows the value of Koppel design, and thoroughness of construction is proven by their use of Koppel Cars, Frogs, Switches and Track Equipment.

In the Rialto Building, San Francisco, we maintain a complete selling and engineering organization under the direction of Mr. Harry C. Kraft.

Put your haulage problems up to these men and they will be glad to make prompt, definite recommendations, without obligation.

Bulletins and Catalogues describing cars suitable for your use mailed upon request.

KOPPEL INDUSTRIAL CAR and EQUIPMENT COMPANY

KOPPEL, PENNA.

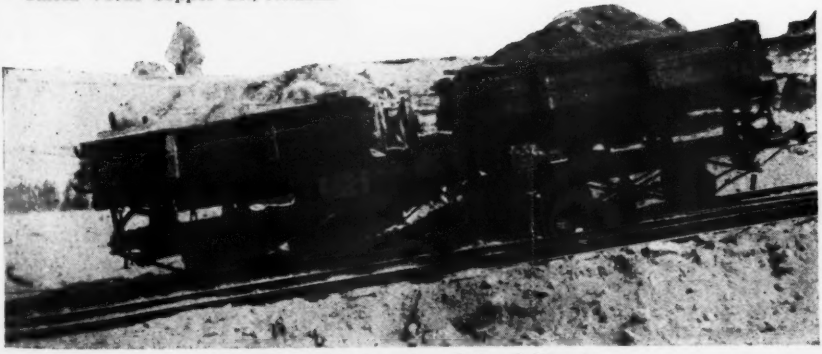
Sales Offices:

Pittsburgh New York Chicago

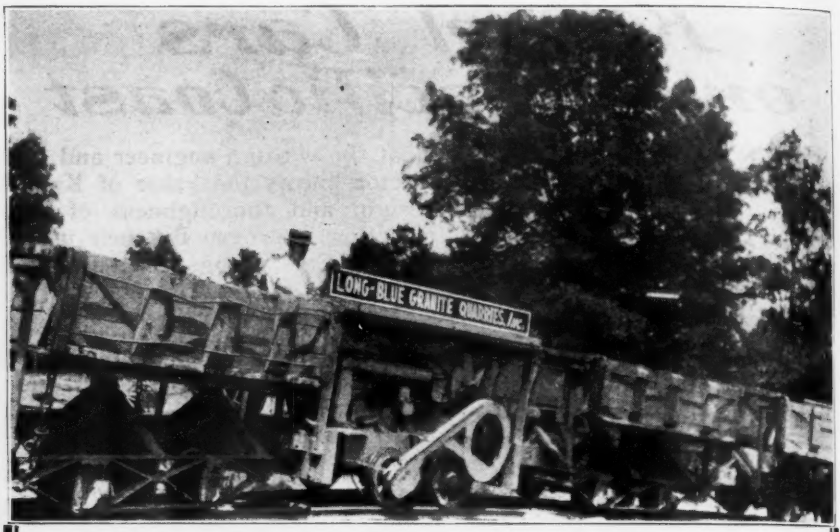
For Pacific Coast

Koppel Sales Company, Inc.
Rialto Bldg.
San Francisco, Calif.

KOPPEL



Big Tejuna Rock & Gravel Co., California



"Humdinger"

is the word used in describing the intense satisfaction and wonderful results obtained from a Brookville Locomotive in operation at the Long Blue Granite Quarries., Inc., Elberton, Georgia:

"The Brookville Locomotive is a 'humdinger'. Takes care of a Link-Belt shovel and crane and does it like a man. It will move and dump anything you can put into a six-yard car, handling two cars over 3 to 5% grade."

No matter what haulage you use, or intend to use, get the facts from Brookville. We strictly guarantee satisfaction from all models for loads and grades within their capacity. Write for our descriptive Bulletin B-1 and B-4.

Brookville Truck & Tractor Company

BROOKVILLE, PA., U. S. A.

BROOKVILLE

GASOLINE LOCOMOTIVES

Rock up to 48 in., loaded by steam shovel, is carried direct to the "Mammoth" crusher and reduced to ¾ in.

Installation of Williams "Mammoth" crusher, Trinity Portland Cement Co., Fort Worth, Texas.

Receiving hopper from where rock is fed to "Mammoth" crusher with apron pan feeder.

New "Trinity" Plant Crushing 48-Inch Rock to ¾-Inch with One Crusher

At the new Fort Worth plant of the Trinity Portland Cement Co. one Williams "Mammoth" crusher does all the raw material crushing. It takes steam shovel feed—any rock up to 48 in. and reduces to ¾ in. in one operation at the rate of 300 tons per hour.

A growing number of the most modern cement and crushed rock plants are installing "Mammoth" crushers because investment is cut 50% to 70% and crushing costs reduced as much as 35% to 53% by doing all the work with one crusher.

In making macadam or railway ballast the "Mammoth" can be adjusted to make no more fines (usually less) than jaw or gyratory crushers. Complete information and users service records gladly sent. Write us.

Williams Patent Crusher and Pulverizer Co.
802 St. Louis Avenue ST.LOUIS, MO.

Chicago	New York	San Francisco
37 West Van Buren St.	15 Park Row	415 5th Street

WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A. THE TORQUE PRINCIPLE REG U.S. PAT. OFF

Williams

ORIGINAL PATENTEES AND WORLD'S LARGEST BUILDERS OF HAMMERMILLS

PATENT CRUSHERS GRINDERS SHREDDERS

PACIFI
GRAVEL PLA
Place their confiden

MOST of the principal sand and gravel producing companies operate with Stephens-Adamson Machinery. Located in Los Angeles with a staff of experienced engineers and with a large shop for fabricating the needs of every sand and gravel operator, the S-A Organization is providing a real service.

S-A Gravel Plants—Known the World Over

STEPHENS-ADAMSON MFG. CO.

FACTORIES:

AURORA, ILL. and LOS ANGELES, CALIF.

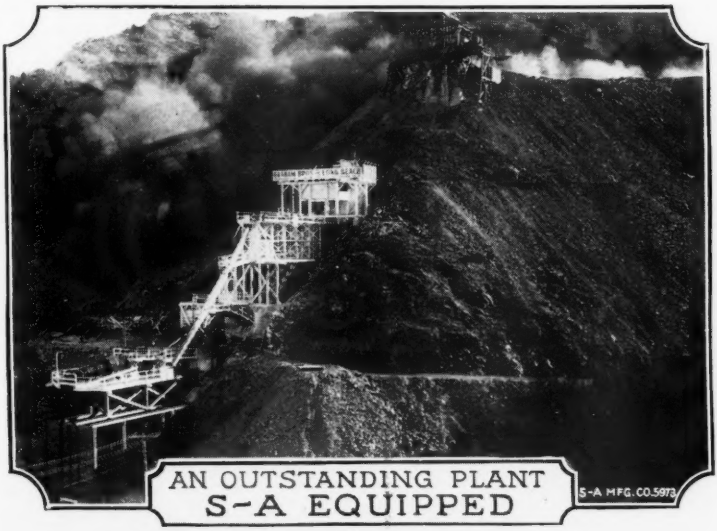
FAS VICE
FRO S-A
LOS LES
FA RY
O L
GRA AN
EQU EN

STEPHENS
S-A BELT

COAST OPERATORS

S-A Equipment

FAST VICE
FROM S-A
LOS ELES
FARY
OIL
GRANT
EQUENT



AN OUTSTANDING PLANT
S-A EQUIPPED

S-A MFG. CO. 5973

ADAMSON

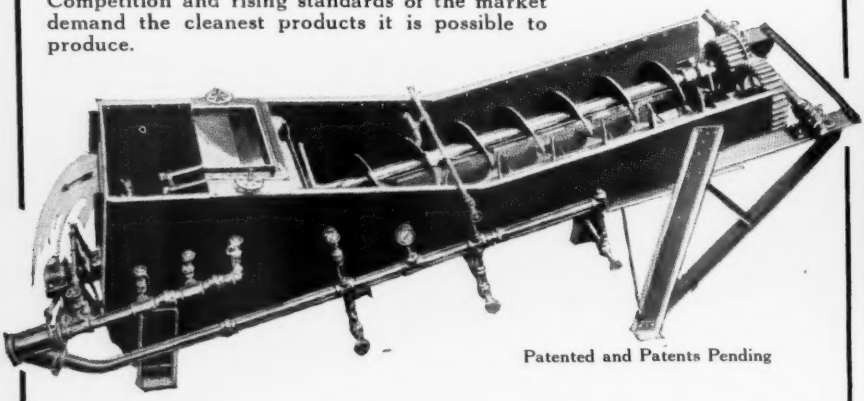
CONVEYORS

GRADE UP YOUR MATERIALS

with a

PERFECT CLASSIFIER

Competition and rising standards of the market demand the cleanest products it is possible to produce.



Patented and Patents Pending

Sand and Gravel Producers

are forever confronted with the problem of keeping their product free of dirt and debris. Much wastage can be avoided and a much higher grade of material produced where the Perfect Classifier is used.

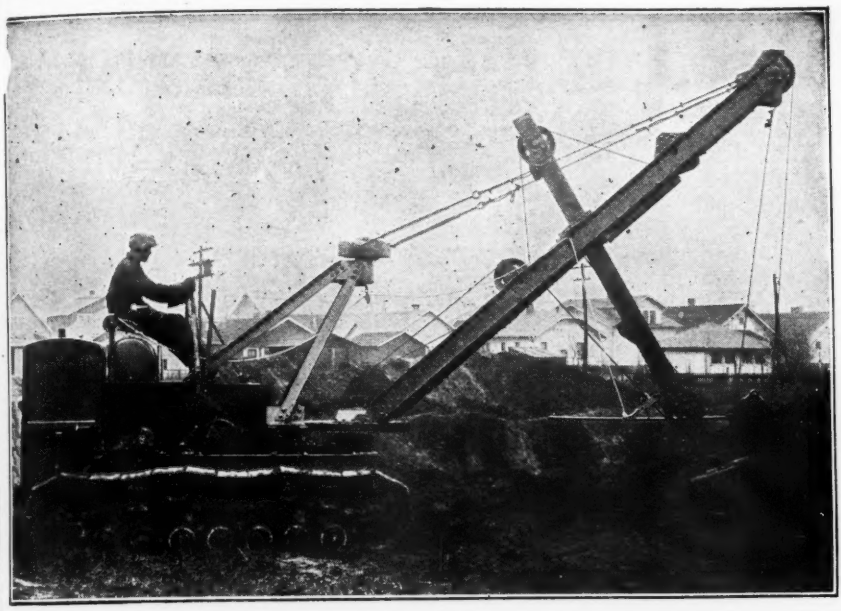
This washer machine has two screw conveyors, operating at slightly different speeds, which produce a scrubbing effect. A continuous high water level keeps the material submerged, freeing it of all mud balls, sticky clay, sticks, leaves, lignite, coal, etc., and delivers the clean product at the high end of the conveyor. With 14 in. conveyors the machine has a capacity of from 40 to 60 tons of gravel per hour. You should investigate this new highly essential piece of equipment.

Write today.

PERFECT CLASSIFIER COMPANY

Manufacturers of ORE CLASSIFIER MACHINERY

105 First Ave., South **NASHVILLE, TENN.**



The Big Man

is not always the best worker although it does cost more to feed him.

and The Big Excavator

does not always handle the greatest yardage although expensive of upkeep and first cost.

INSLEY

CONCRETE PLACING EQUIPMENT

STEEL DERRICKS

BUCKETS AND CARS

EXCAVATING EQUIPMENT

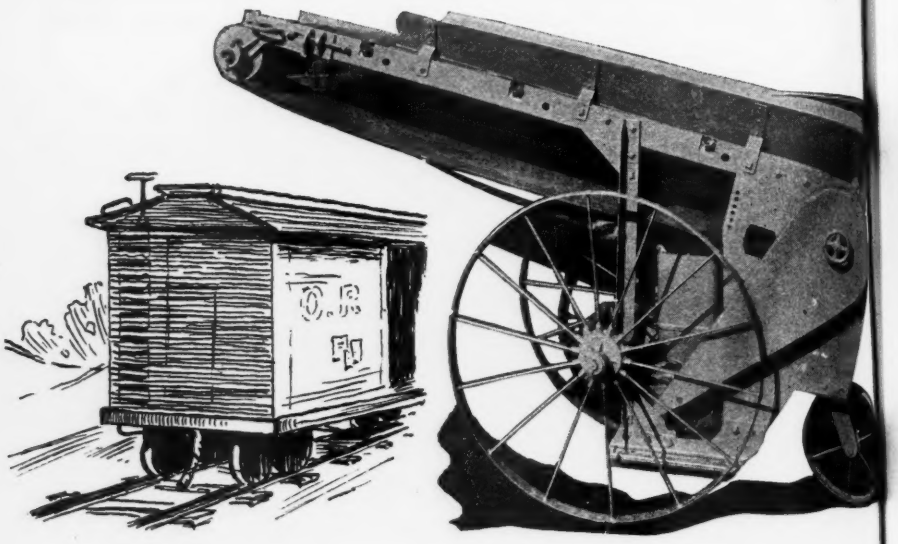
The INSLEY EXCAVATOR for shovel, ditcher or skimmer scoop work will handle the daily yardage required on the average sized job and because of its mobility and speed of operation will get on the job, do the work and get away just as rapidly as a larger and more expensive unit.

A Buda power plant, crawler traction and its patented rope crowd result in a real Excavator of comparatively low first cost. In justice to yourself you should write for Bulletin No. 47 and thoroughly investigate the machine before securing any of your 1925 equipment.

INSLEY MANUFACTURING COMPANY

Engineers and Manufacturers

INDIANAPOLIS



Ottumwa Box Car Loader

Economy and speed in marketing are two of the most important present day conditions that have to be met. Use efficient and up-to-date methods in solving these problems. Mechanical loading is a success, in saving time, money and men. You can help solve your problem and realize permanent satisfaction through the operation of the Ottumwa Box Car Loader.

The Ottumwa Loader is an established success in the pit and quarry industries. It eliminates loading gangs, reduces costs, prevents delays and increases capacity.

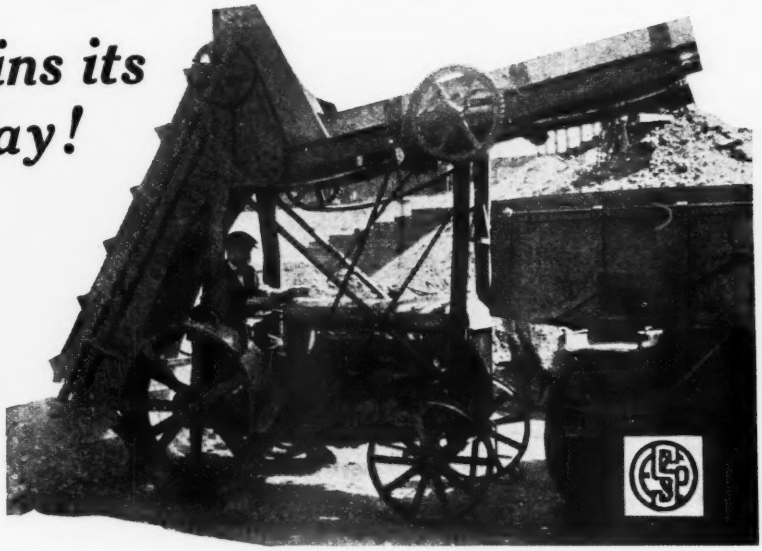
The Ottumwa is manufactured with electric or gasoline power, has roller and ball bearings throughout and is equipped with the latest Alemite greasing system.

Write for further information and prices.

OTTUMWA BOX CAR LOADER CO.
OTTUMWA, IOWA

Specialty Fordson Loader

Wins its Way!



You Want the Best Loader Made!

The Specialty Fordson Loader is the answer to the demand for a portable loader moving and operating under its own power. There is no more compact loader made, for this outfit has much greater power than the conventional stationary outfit, and at but slight additional cost.

The Specialty Fordson Loader crowds while the buckets are in operation, independent of reverse gear, and it can be crowded much or little at a time. The crowding mechanism is self-contained with gears running in oil. The feeders clear a path sufficient for the tractor wheels. If you want simplicity of operation and dependability, install a Specialty.

Write for full information, mailed on request.

Specialty Engineering Company

Allegheny & Trenton Aves. **Philadelphia, Pa.**

Depend Upon Grasselli for Profitable Results

THE reason why so many quarrymen depend upon Grasselli for big production and big profits is the results they get from the first shot.

No matter how hard the shooting problem may be, there is a grade of Grasselli Explosives that will do the work well—bring the stone down clean from the face in the size and condition you want—with no dangerous overhangs and but a minimum of big blocks for secondary blasting.

If you are not getting the results you should—if you are in doubt about the grade of Grasselli necessary to perform your work, call in a Grasselli Service Man. He can help you and his services are yours for the asking.

The Grasselli Powder Company

Main Office: Cleveland, Ohio

Branches:
Philadelphia
Bluefield, W. Va.
Birmingham
Wilkes-Barre, Pa.
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ESTABLISHED 1839
CHEMICALS
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DYESTUFFS

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The Grasselli Powder Co., of Florida, Miami, Florida

GRASSELLI EXPLOSIVES

HAISS LOADERS

Cut Costs at the Sand Bank or Stockpile

Represented on the Pacific Coast by

The Brown-Bevis Co., Inc.
470 E. 3rd Street
Los Angeles, Calif.

A. L. Young Mchy. Co.
26 Fremont Street
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S. 13 Post Street
Spokane, Washington

Brown, Fraser & Co., Ltd.
1150 Homer Street
Vancouver, B. C., Canada

They have put truck loading on an efficiency basis for such representative Pacific Coast operators as:

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Sharp & Fellows, Los Angeles
Oakland Paving Co., Oakland
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Federal Trans. Co., El Centro
The Griffith Co., Los Angeles
U. S. Gov. Dist. Engr., Ft. Barry
Woods-Beekman Lbr. Co., Beverly Hills
National Rock & Gravel Co., Inc., Los Angeles

These and other Haiss Loader users are handling sand, stone and other material at low cost—and speeding up the "get-away" of their trucks. The machine illustrated will load up to 2 cu. yds. per minute, with one man (the operator) only. It is self-propelling, self-feeding, self-crowding—and with the power of its 37 H.P. motor will dig and load right from sand or gravel bank. There are Haiss Loaders of several types—one for every truck loading need.

Let us send Catalog 523

Manufacturer of THE GEORGE HAISS MFG. CO. INC. Established 1892
--Truck and-- Wagon Loaders
Portable Belt Conveyors
Clam Shell --Buckets--
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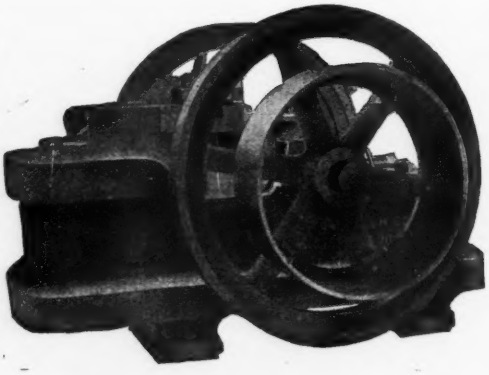
IS YOUR PROBLEM LISTED HERE?

We are in position to help you meet your problem in a speedy, satisfactory manner, if it pertains to crushing, grinding, screening, washing, drying or conveying, for we manufacture a full line of this equipment for pit and quarry service.

These are reasonably priced, well built, compact outfits—efficient and quickly installed.

Will you drop us a line, stating what equipment you desire information on?



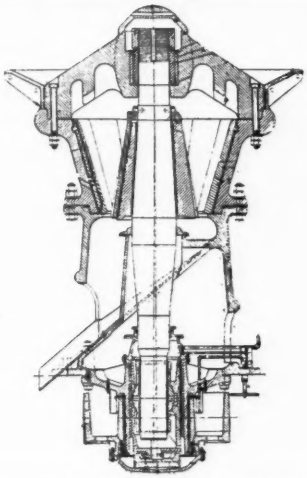
Lewistown Fdy. & Machine Co.
LEWISTOWN, PENN.

THE CRUSHERS

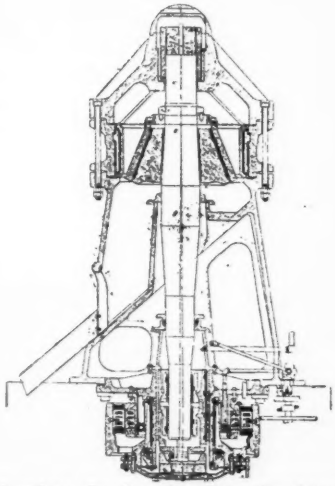
with the Troubles Left Out

WHY THEY LEAD

1—They are noiseless and run like watches.
2—50% greater capacity for same power.
3—Practically no wear on anything but head and concaves.
4—Short shaft and saving in head room with packed dust collars.
5—Shaft reinforced with self-locking head so that it cannot break where 90% of shafts have broken.
6—Can be driven right, left, or standard, as sent from shop.
7—Eccentric is turned by flexible coupling attached to pulley, which prevents side thrust and heating, as in geared crushers.
8—Ball and socket eccentric, self-aligning, eliminating friction and heating. Runs for years without attention.
9—Positive circulating oil system through filter and cut geared oil pump.
10—Made in our own shop by experts, trained for the job.
11—It is a crusher with the trouble left out. See it in operation, and you are unfit to listen to any geared crusher salesman. In fact, if you are near one of his machines, you can't hear him, if you are so inclined.



Standard Ball Bearing Gearless Crusher. Sizes No. 1 to No. 60—Weights 1,000 to 900,000 lbs.



Gearless Crusher for Fine Crushing. Do not be deceived by Vertical Concaves; that is not what makes a fine crusher.

12—Our fine crusher does the work of 4 geared crushers.

Send for catalogue and tell us what your problems are, and one of our experts will call on you without obligation on your part.

KENNEDY VAN SAUN MFG. & ENGR. CORP.

50 Church St. **NEW YORK**

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TELSMITH

Introduces a New Principle in Sand Tank Design—

IN this tank, the automatic discharge does not depend on the slight difference in weight between water and sand. As the sand builds up near the baffle plate, the water rises in compartment A. The accumulated sand helps to tip the tank; but it is this additional water that makes Telsmith really automatic, where other tanks are not.

The rapid adjustment of the water level assures a steady even "breathing" of the valve, which discharges the sand in small quantities but almost continuously. The deep sand bed is left undisturbed, preventing sudden gushes of dirty water into the bins. These are not mere *claims*. We *guarantee* this tank to work automatically all day and every day, without any attention, dewatering within 22-25 per cent, and passing only 5 to 8 per cent free water into the bins. May we send you Bulletin S-T-15. No obligation.

SMITH ENGINEERING WORKS

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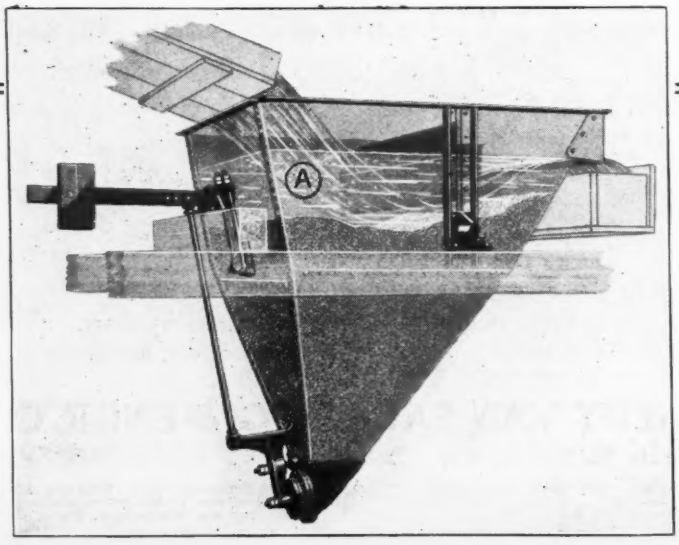

Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy for you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs, prices or other information.

- ☐ Agitators
- ☐ Air Compressors
- ☐ Air Compressors, Portable
- ☐ Babbitt Metal
- ☐ Baffles
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- ☐ Bag Sewing Mach.
- ☐ Bags, Cotton
- ☐ Bags, Paper
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- ☐ Belting, Transmission
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- ☐ Blasting Powder
- ☐ Block Machinery, Concrete
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- ☐ Car Wheels
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- ☐ Cars, End Dump (Gauge .....in.)
- ☐ Cars, Side Dump (Gauge .....in.)
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- ☐ Castings, Special Metal
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- ☐ Clutches
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- ☐ Conveyor Equipment
- ☐ Conveyor Rollers
- ☐ Couplings, Flexible
- ☐ Cranes, Electric Traveling
- ☐ Cranes, Jib
- ☐ Cranes, Locomotive
- ☐ Cranes, Traction
- ☐ Crusher Parts
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
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- ☐ Crushers, Jaw
- ☐ Derrick Swingers
- ☐ Derricks
- ☐ Dippers
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom

(Continued on next page)

- ☐ Dragline, Scraper
- ☐ Dredges, Dipper
- ☐ Dredges, Land
- ☐ Dredges, Sand Suction
- ☐ Drill Steel
- ☐ Drilling Contractors
- ☐ Drill Sharpening Machines
- ☐ Drills, Blast Hole
- ☐ Drills, Hand Hammer
- ☐ Drills, Tripod
- ☐ Dryers, Sand and Stone
- ☐ Dry Pans
- ☐ Dump Wagons
- ☐ Dust Collecting Systems
- ☐ Dynamite
- ☐ Dynamos, Electric
- ☐ Economizers, Fuel
- ☐ Elevating Equipment
- ☐ Engineering Service
- ☐ Engines, Gasoline (H. P.....)
- ☐ Engines, Gasoline Portable Power Unit (H. P.....)
- ☐ Engines, Hoisting
- ☐ Engines, Hydraulic Pumping
- ☐ Engines, Oil (H. P.....)
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- ☐ Gears
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- ☐ Mixers, Concrete
- ☐ Mixers, Plaster
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- ☐ Motors, Gasoline Portable Power Unit (H. P.....)
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- ☐ Nozzles, Hydraulic Mining
- ☐ Nozzles, Suction Screen
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- ☐ Picks and Shovels
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- ☐ Pipe, Spiral
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- ☐ Scales, Automatic, Conveyor
- ☐ Scales, Track
- ☐ Scrapers, Power
- ☐ Scrapers, Team
- ☐ Screening Equipment

(See other side)

- ☐ Screens, Perforated Metal
- ☐ Screens, Rotary
- ☐ Screens, Vibrating
- ☐ Separators, Air
- ☐ Separators, Gypsum
- ☐ Separators, Magnetic
- ☐ Separators, Sand
- ☐ Sheaves
- ☐ Shovels, Electric (.....yd.)
- ☐ Shovels, Gasoline (.....yd.)
- ☐ Shovels, Steam (.....yd.)
- ☐ Speed Reducers
- ☐ Steel Barrels
- ☐ Steel, Drill
- ☐ Steel, High Speed
- ☐ Steel, Manganese
- ☐ Steel, Structural
- ☐ Stokers, Automatic
- ☐ Stone Grapple
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- ☐ Superheaters
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- ☐ Tackle Blocks
- ☐ Tampers, Concrete Block
- ☐ Tanks, Settling
- ☐ Tanks, Steel
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- ☐ Tile Machinery, Concrete
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- ☐ Turbines
- ☐ Unloaders, Bin
- ☐ Unloaders, Boom and Bucket
- ☐ Unloaders, Conveyor
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- ☐ Washers, Log
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- ☐ Welding Equipment
- ☐ Winches
- ☐ Wire Cloth

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Repeated Loads

Trust Yellow Strand Wire Rope to hold up its end of the tough work required of your heavy-duty derricks, steam shovels, cranes and excavators.

Every wire in its make-up has 240,000 to 260,000 pounds tensile strength per square inch. Elasticity—the power to keep its "spring" through the shock of thousands of suddenly applied loads—is laid up into the rope at the factory.

Next time you change the lines change to Yellow Strand — and economy.

Write for catalog 25 and name of nearest distributor of Yellow Strand and other dependable B. & B. Ropes of standard grades.

Broderick & Bascom Rope Co.
St. Louis, Mo.

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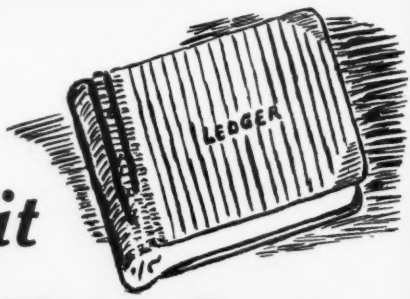
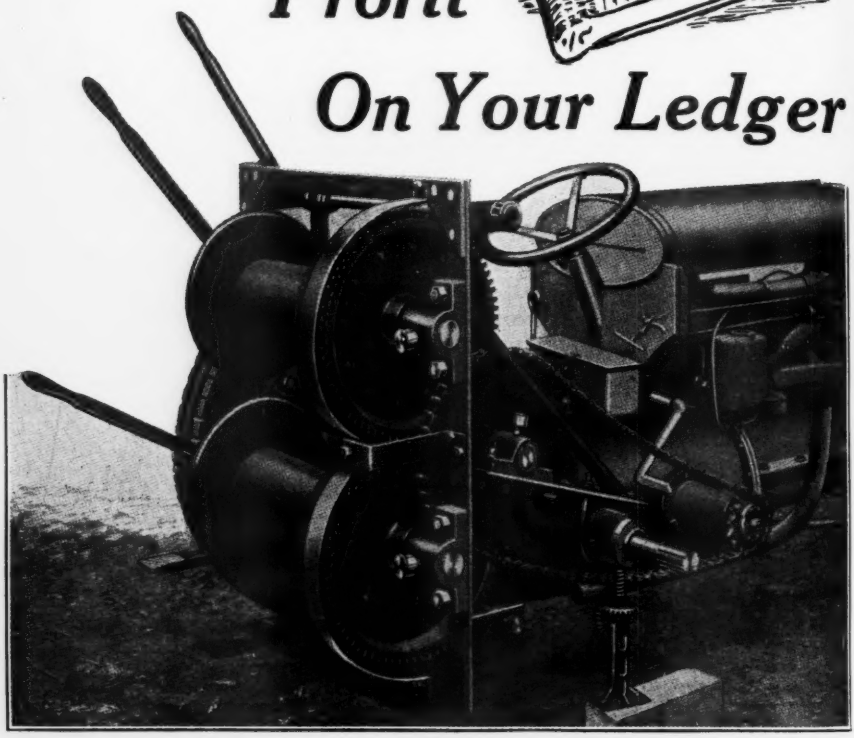
76 Warren St., New York City
Western Office: Seattle, Wash.
Factories: St. Louis and Seattle

Builders of B. & B. Aerial Tramways for Industrial Haulage. J466

Show a Profit On Your Ledger





Continental Winches

will show you a profit through their powerful uniform hoisting energy every day in the week. A dependable unit that can be relied on every minute under every working condition.

Continental Winches are made in two types—friction drive and gear drive, and two sizes—single and double drum.

The friction type is used extensively for loading logs and heavy objects that require careful handling or speedy operation. It is especially adapted for dragline scrapers, and when mounted on the Fordson Tractor, it makes a most complete, and economical unit.

The powerful brakes which control the drums are operated with convenient foot levers, excepting the top drum on the double drum type, which is operated by hand. Speed ranges from 60 to 200 ft. per minute on all lines.

Every Continental Winch is unconditionally guaranteed against defective workmanship and materials. Defective parts replaced F. O. B. Memphis without charge.

UNIVERSAL EQUIPMENT CO., Inc.

P. O. Box 2673 1444 Riverside Blvd.

MEMPHIS, TENN.

"Pioneer Excavating Material for Skagit River Project"

PIONEER Back-Dump BUCKET

The Economy Bucket for your Excavation. Saves Time, Power and Money.

THE Back-Dump feature alone makes the Pioneer the choice of men who value time as money. Just consider the speed made possible by the back-dumping, and you have reason enough for choosing the PIONEER for you slackline work.

The PIONEER Bucket increases the capacity of any slackline plant. It works in either wet or dry pits, and is exceedingly sturdy in construction.

This Bucket has won the unqualified approval of plant owners and contractors throughout America. Get acquainted with it.

—

Send for Catalog "X"

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PIONEER BUCKET COMPANY

Successors to

The Mansfield Engineering Co.

1011 Fletcher Trust Bldg.

INDIANAPOLIS, IND.

You also, can get this information from your HAND BOOK

CALCIUM PRODUCTS COMPANY

HOLLIDAYSBURG, PA.

MANUFACTURERS OF

HIGH CALCIUM CHEMICAL LIME

J. D. HARTMAN
MANAGER

March 9, 1925

The Complete Service Publishing Co.,
Rand-McNally Building
Chicago, Ill.

Gentlemen:

This will acknowledge receipt of your Pit and Quarry Handbook for 1925.

For your information, we have had business dealings with not less than twenty-five of the manufacturers listed, this company as well as the J. L. Hartman Company which have been under one management in the past. Your handbook has been especially helpful in covering as it does their entire lines of quarry machinery and supplies. The information it contains is especially helpful in many problems.

We feel under great obligations to you for sending us a book of so much useful information, and desire to thank you very kindly for same.

Yours very truly,

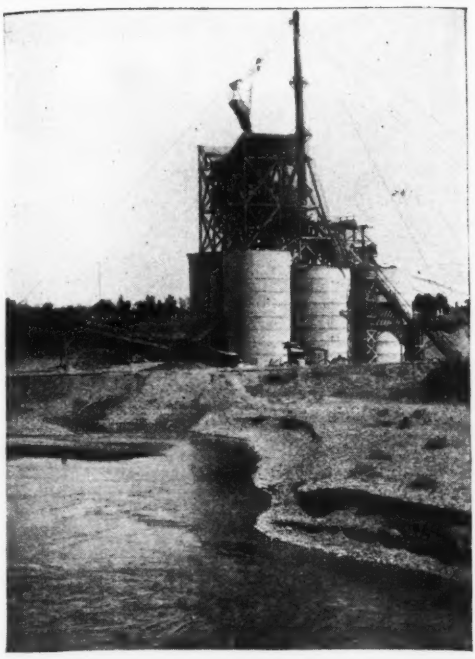
J. D. Hartman

JDH-S

The habit of using Pit and Quarry HAND BOOK is a time and labor saving habit Within the covers of this book you will find the answers to your problems on operation and equipment. You will find information that can save you many a dollar and many an hour.

Pit and Quarry HAND BOOK

Rand, McNally Bldg. **Chicago, Ill.**



This 1 cu. yd. Sauerman Slackline Cableway operated by the Stoney Creek Gravel Co., Willows, Calif., when digging 400 ft. from the plant, delivers to the screens 60 cu. yd. an hour, and is very economical to operate with its smooth running Sauerman 2-speed electric motor hoist, says Mr. Twede, the plant superintendent.

SAUERMAN Slackline Cableways and Power Drag Scrapers are working in sand and gravel deposits of almost every kind. Some are tearing down huge hills and banks; some are spanning streams to take out river material; some are working in deep pits many feet under water. They are making money for small operators and for large plants requiring thousands of tons daily. Hundreds of these installations are illustrated in our pamphlets which will be sent free on request.

The State Gravel Co., Tacoma, Wash., uses a 2 cu. yd. Crescent Power Drag Scraper to excavate material from a high bank, as shown above. "This Sauerman Scraper machine is the best thing of its kind we have ever seen," writes W. R. Nichols, president of the company.

SAUERMAN BROS., Inc.

434 S. CLINTON ST. CHICAGO

SAUERMAN

SLACKLINE CABLEWAYS : POWER DRAG SCRAPERS

Plain Common Sense

When a quarry owner buys a second shovel of the same make as his first, you can be sure he found the first one all and more than he expected.

The Lutz Stone Company at Oshkosh, Wis., first bought the Thew 3A Electric shown above. It had some real work to do to make good, as you can plainly see.

Later they bought a Type O Thew Gasoline Combination Shovel and Crane for general utility work about the quarry.

It was another Thew, because——

Well, you know why.

THE THEW SHOVEL COMPANY, LORAIN, OHIO

Thew Lorain Shovels

Dig Faster–Last Longer

Pit and Quarry

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Great Western P. C. Co., Kansas City, Kan.
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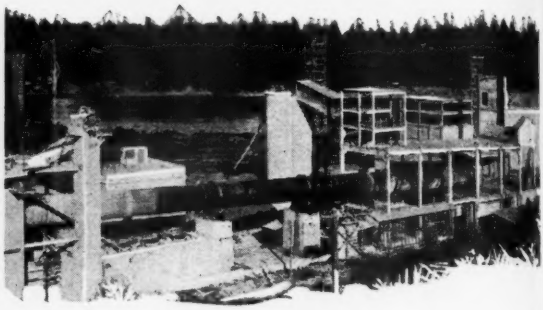

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Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

VOL. 10 CHICAGO, ILL., SEPTEMBER 15, 1925 No. 12

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Pass it on

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A Truck-Load In Every Bucket

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The one man operation, low fuel cost and entire freedom from repairs during the ten months they have had the Bear Cat, has made this a very economical proposition for Gottron Bros. The Bear Cat is moved about quickly and easily on its full crawler treads, making it much more practicable than a stationary derrick or a machine on any other kind of mounting.

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Pit and Quarry

Vol. 10 Chicago, Ill., September 15, 1925 No. 12

The Cement Industry on the Pacific Coast

MODERN cement manufacture began on the Pacific Coast with the construction of a plant in 1898 at Colton, California, about fifty miles east of Los Angeles, with an initial capacity of 500 barrels per day. The second plant in California was constructed at Cement, California, about half way between San Francisco and Sacramento, in 1902, with an initial capacity of 1600 barrels per day. The total production of cement in California in 1902 was 171,000 barrels.

At the present time there are ten active cement plants with a total daily capacity of 50,000 barrels, or an annual capacity of 18,000,000 barrels. The maximum shipment of cement in the history of California was in 1924 when approximately 12,000,000 barrels were shipped by the manufacturers of that state.

The first modern plant constructed and operated in Oregon was in the year 1915, at Oswego, seven miles from Portland, with a daily capacity of 1,100 barrels. There are now three active plants in Oregon, with a daily capacity of 3,300 barrels or an annual capacity of 1,200,000 barrels.

The first cement plant constructed in the state of Washington was in 1906, which plant had a daily capacity of 1200 barrels. There are now four active plants in this state with a daily capacity of 10,000 barrels, or an annual capacity of 3,500,000 barrels. The largest year's shipments in this state were in 1924 when less than 2,000,000 barrels were actually shipped by the local cement companies.

The cement producing capacity of the Pacific coast mills is approximately 23,000,000 barrels per year with a maximum demand of 15,000,000 barrels. The per capita consumption of cement by the Pacific Coast states is considerably over that of the average in the United States. The state of California leads all states in the consumption of domestic cement per capita.

The climate of California is a deciding factor in maintaining the demand for cement at a fairly uniform level throughout the year. The cement producing capacity of California has been stimulated during the last two years by a sharp uptrend in building and a somewhat favorable highway program. A condition that is looming up as a real problem is the competition of foreign cement. Foreign cement has been entering Pacific Coast ports in large quantities. At San Francisco domestic cement is now selling at $2.70 per barrel while Swedish and Belgian cements are selling at $2.35 per barrel. The problem is to get the Pacific coast engineers to specify domestic cement to the exclusion of foreign cement.

Conditions in Oregon and Washington are quite discouraging compared with those of California. When the plant of the Inland Portland Cement Company, (now the Lehigh Portland Cement Company), was built at Metaline Falls and first shipments were made in 1911, the prospects for operating that plant at capacity were very favorable. The construction of many power projects, including the Long Lake Dam, the construction of the C. M. & P. S. Railway to the coast, the North Bank Line to Portland, several bridges in Spokane, requiring about 50,000 barrels of cement each, the grade separation of the Northern Pacific Railway at Spokane, the continued prosperity of the towns and cities of the Inland Empire, resulting in extensive building construction, indicated an era of prosperity which included the manufacture of cement.

As a result of this outlook the International Portland Cement Company constructed its plant at Irvin, Washington, eight miles east of Spokane, and the Three Forks Portland Cement Company constructed a plant

at Hanover, Montana. Building construction, however, did not continue to increase, and the Metaline Falls plant reached its peak shipments during 1912 when the plant was operated at a little less than seventy per cent of its capacity.

Before the completion of the Hanover plant, agriculture had a decided backset due to droughts, which have continued for about seven years. The consumption of cement in the territory served by these plants has each year declined until 1924, when the sales approximated about twenty per cent of the capacity of the plants.

During this period road construction became very active, but there was very little hard surface paving requiring cement, except in the State of Washington. However, as the population and revenue of the state comes principally from the western slope of the Cascade Mountains, about seventy per cent of the total money expended for concrete roads in the State of Washington has been in the western part of the state, in close proximity to the plants located at Concrete and Bellingham, Washington. The road construction, however, did not begin to offset the loss of tonnage due to unfavorable building conditions in the Inland Empire territory.

The cement manufacturers view the situation in the Inland Empire territory as being anything but encouraging. They feel that if they are able to operate their plants at even fifty per cent of their capacity for several years, they will be fortunate. They do not believe there will be any increased demand for cement until the population is materially increased, and just how this can be brought about is one of the big problems of the community. Diversified farming will help some, but this will take many years and probably call for the development of some of the larger projects before it will increase materially the consumption of cement.

Should the projects now being promoted, such as the Lewiston Power Dam, the Priest Rapids Project and several others of a similar nature materialize within the next few years, the present mills would be able to supply all the cement needed and still be far short of operating their mills at full capacity. The Columbia Basin Project, of course, would require a large amount of cement, but it would be spread over many years of construction and the present plants in operation could also take care of any demands resulting from this project without increasing their capacity.

The plants already operating in this field have continued business on this small production without any possibility of returning dividends to their owners. The companies, however, have kept their plants in good repair at a considerable cost, hoping that some day they may be able to operate at something like their capacity and justify their investment.

Domestic cement prices are reasonable and, of course, should be given preference to foreign cement. However, the situation can be effectively met only by an absolute boycott. Such a situation would remove the only difficulty facing California at the present time and would bring some relief to the producers of Oregon and Washington.

Our Interest in the Pacific Coast

ATTENTION is being focused upon the Pacific Coast by many industries at the present time. The possibilities of this vast area with its wonderful resources and its relation geographically to the Far East are factors which will eventually give this area of the United States an advantage which will not be equalled. Australia is rapidly becoming a modern continent and is a tremendous potential market. Contrary to the general belief, China is making rapid strides toward civilization as understood in the United States. The vast financial resources of India will some day be released for the benefit of its population.

During the past few years great progress has been made both in number and efficiency of non-metallic operations on the Pacific Coast. Our editorial staff is making a special first hand study of the problems confronting these plants, the method of operation and future possibilities. This number of Pit and Quarry is devoted entirely to operations on the Pacific Coast. Future numbers will contain articles descriptive of conditions and other operations. Those operations which appear to be of interest at the moment will be discussed first.

Superior Portland Cement Company Operates Labor Saving Plant

By E. D. Roberts

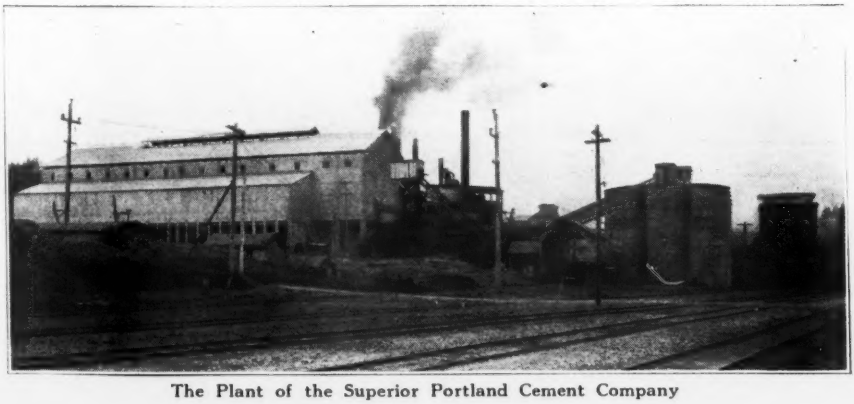
MOST extraordinary is how an English cement manufacturer characterized the cement plant of the Superior Portland Cement Company at Concrete, Washington. And it truly is remarkable in its many aspects of special interest. It is today one of the outstanding plants in the United States and a distinct credit to the Pacific Coast.

The plant is located in the town of Concrete on a branch of the Great Northern Railroad at the junction of the Baker and the Skagit Rivers. The quarry is on a limestone bluff which rises above Baker River on the east side and is about 1½ miles from the mill. This quarry has a high face and an extremely hard rock. The drilling operations are quite a problem. Tunneling was at one time employed in securing the stone. The present method, which is described further on in this article, employs super electric traction drills. This company manufactures its own electric power from a hydro-electric station. Operations at both the mill and the quarry require about 3,600 K.W. The present mill capacity is 4,700 barrels per day. The kilns vary from 135 to 192 feet in length and from 7 to 9 feet in diameter. The clinker storage is entirely enclosed. The crushing plant is a reinforced concrete structure. Neat, sanitary dwellings adjoin the plant and the office building is an attractive concrete building. Railroad quarry transportation has been supplanted by an aerial tramway 6,700 feet long.

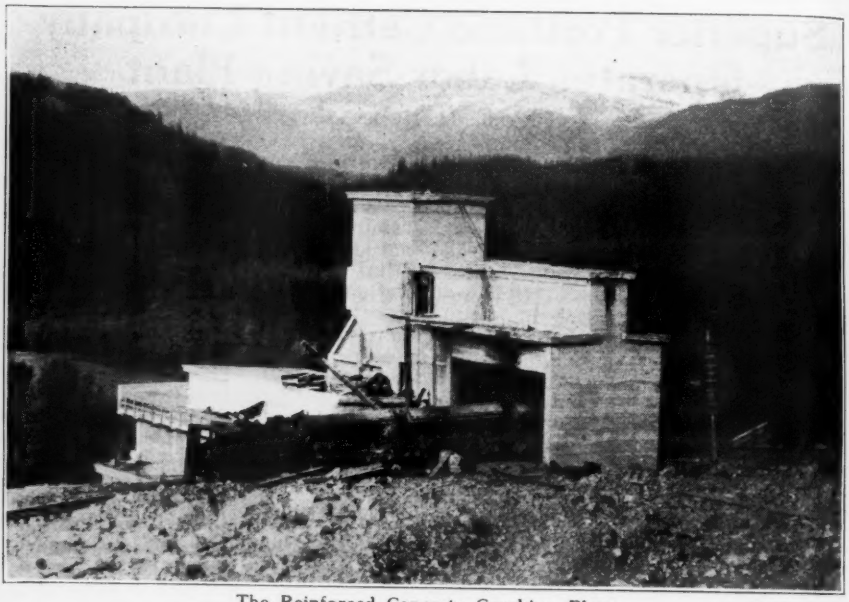
Carrying eighty-eight buckets containing one cubic yard each, the new aerial tram of the Superior Portland Cement Company of Concrete, Washington, is now dumping rock into its new tram terminal at the rate of 235 tons per hour after transporting it a distance of 6,700 feet from the quarry tram terminal. This tramway is very unique in that the towers are constructed of reinforced concrete with a steel framework on top holding the cables supporting the buckets. Heretofore, rock has been obtained from the same quarry by means of a standard gauge railroad with trains of side dump cars, owned and operated by the company.

The Stone and Webster Engineering Company is constructing a dam across Baker River between the mill and the quarry for the development of electric power. This dam is being built over the railroad and will soon block the track with concrete and water. This was the main reason for the construction of the tramway at this time, although it has been known for some time that a tramway would cut the cost of rock transportation considerably.

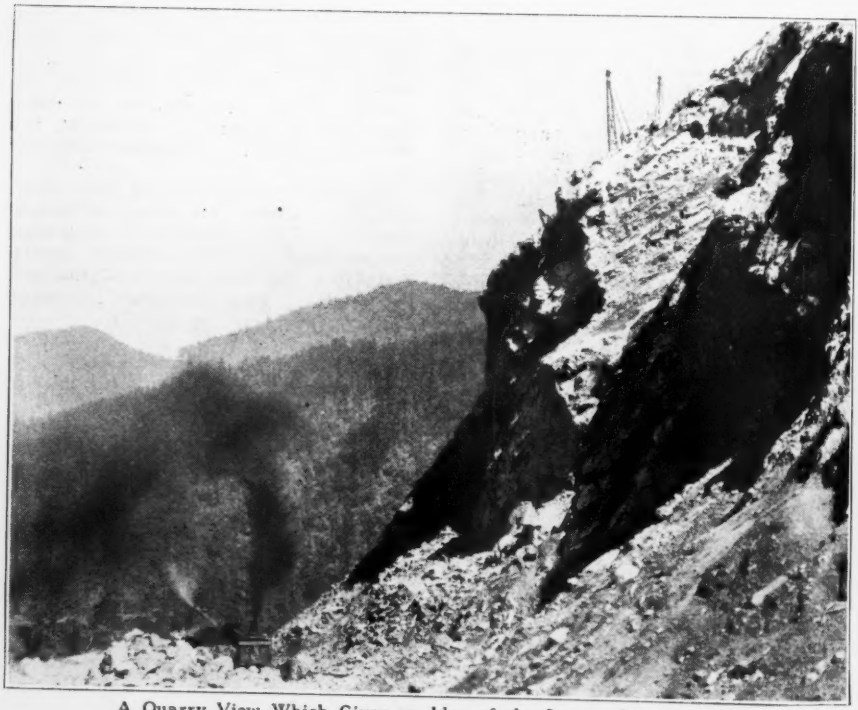
The lime rock is covered with about 6 feet of earth and debris, which is removed by hydraulic operations. Quarry operations to date have opened it up to a 180 foot face for 1,500 feet in length. Two Cyclone 14 super



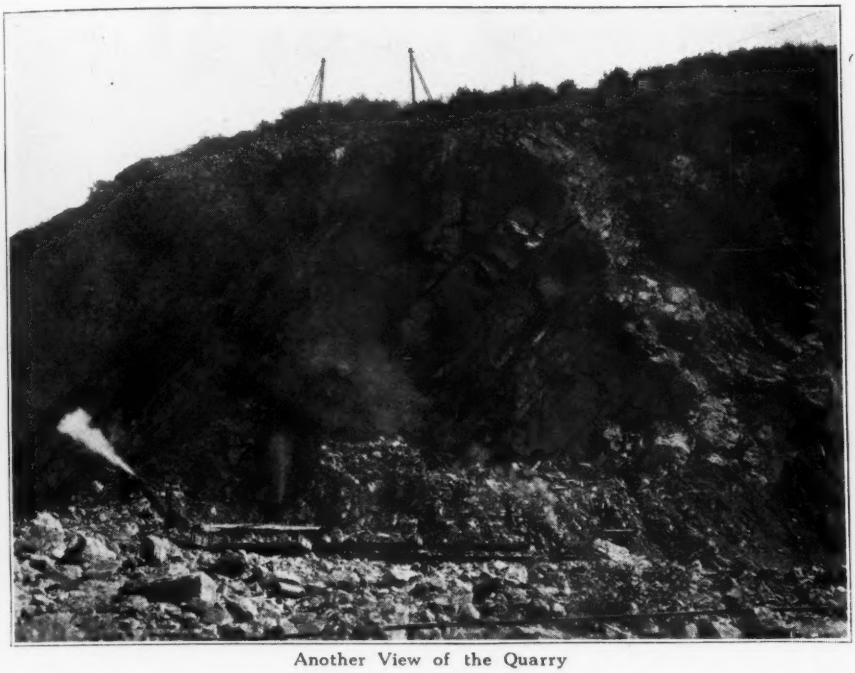
The Plant of the Superior Portland Cement Company



The Reinforced Concrete Crushing Plant



A Quarry View Which Gives an Idea of the Surrounding Country



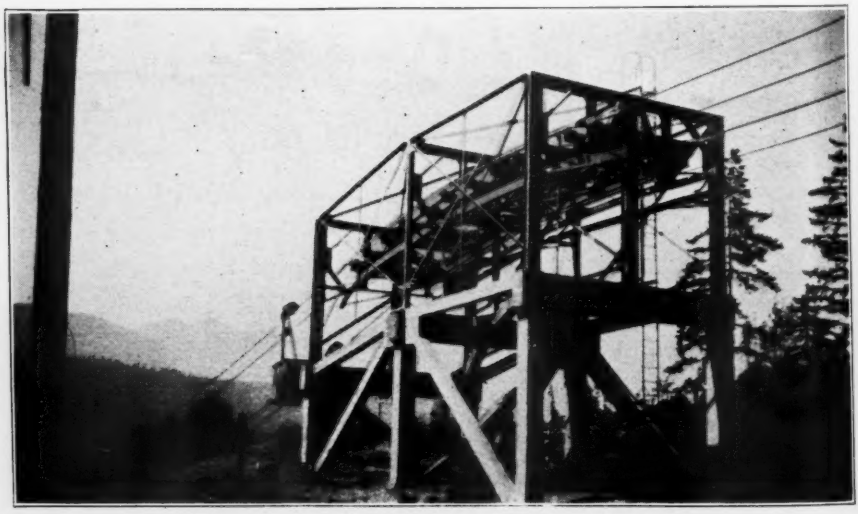
Another View of the Quarry

Shepard 11-Ton Crane Reclaiming Rock From Storage

Tramway in Operation Over 1,000-Foot Span

electric traction well drills sink 8 inch holes until they are 6 feet below the quarry floor for breaking down the rock. Coyoting is sometimes resorted to also. Two 60 ton Marion steam shovels load the rock on to 6 yard side dump cars that are hauled to the crusher house by dinkey locomotives. One dinkey handles three cars at a time and serves one shovel.

The crusher building is a commodious reinforced concrete structure. The trains of rock are brought into it at the top. A hook on a long cable from overhead is hooked into the chain which overturns the car as it moves along dumping the rock into a 42 inch Traylor Bulldog crusher that gives it a preliminary breaking to a maximum of 8 inch thickness. A bucket elevator raises the rock to a bin for the second stage grinding. A battery of 4 Gates crushers is placed along side and below this bin from

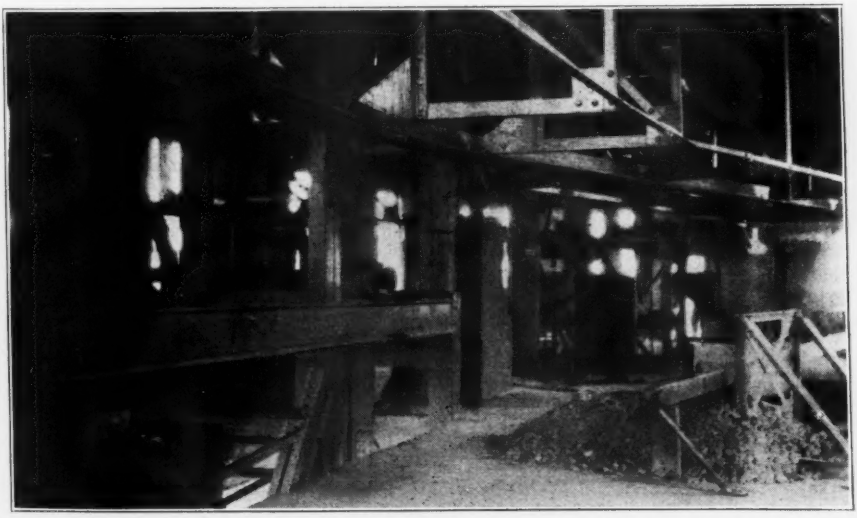


Tower Station Where Tramway Goes Over Mountain

Side View of Tramway Shows Structural Steel Supports

which it is fed to the crushers by means of 4 Sheridan feeders. A 30 inch conveyor belt operating under the row of crushers carries the rock, which is now broken to a 3 inch maximum, to a 30 inch inclined Link Belt conveyor 350 feet long which carries it to the top of the tram terminal bin.

Various makes and sizes of motors are used to operate the crusher machinery, the largest being a 250 H P. Allis Chalmers motor which operates the large Traylor crusher. Several Bullock and General Electric motors are used. Two Ingersoll Rand compressors, each 14x12 furnish compressed air for the quarry. Traveling overhead cranes are provided over the crushers to facilitate handling. A rock testing laboratory is maintained here, taking hourly rock samples for controlling the mix when fed to the raw mill. A power house transforms the electricity



Interior View of Unloading Tram Terminal

from 12,000 to 550 volts as used in the various motors.

The new tram terminal is a large reinforced concrete structure. A silo with a capacity of 1,000 tons of rock forms the center around which the buckets travel when coming to and leaving the loader. A one story house has been built around the rock silo to house the terminal machinery and bucket loaders. Coming into the terminal on the empty line, the bucket is released from the traveling cable by an automatic trip and rolls on to the curved rail structure. It is shoved to the loading position where it is held in place while being filled with rock. A chute has been tapped into the rock silo which guides the rock into the tram bucket. Compressed air furnishes the means to operate a gate in the chute. When loaded, the tram bucket is shoved around to the end of the curved rail structure and on to the load cable; the clamp is thrown over and the bucket of rock starts for the mill.

As stated before, the aerial tram is 7,600 feet long and is supported by reinforced concrete towers. Alternate designs for reinforced concrete and structural steel towers were prepared and bids received on each design. The lowest bid was for reinforced concrete towers. This was probably due to the fact that the design was made so that the forms could be used over and over. The longest span is that over the Baker River which is 1,000 feet from tower to tower. The load cable is 1⅝ inch and the empty cable is 1 inch track cable. The American Steel and Wire Company designed, furnished and supervised the installation of this tramway.

Installation of a guard net under the buckets where the tramway crossed three streets in the town of Concrete was required. Consequently 11¾ inch cables each 850 feet long were stretched over the reinforced concrete towers supporting the tramway as well as over several intermediate towers likewise constructed on reinforced concrete. The cables were fastened into huge concrete deadmen at the ends, adjustment being provided for by turnbuckles on the mill end of the cables. At intervals of five feet, 3x5x⅜ inch angles were laid across and clamped to the underside of the cables; a number 6 gauge wire mesh with 2 inch openings was laid over this with the sides turned up for 18 inches and held there by vertical 2x2½x¼ inch angles riveted to the large cross angles. This net, 18 feet in width, is to catch all rocks that might fall from the loaded buckets or to catch a bucket in case it should fall.

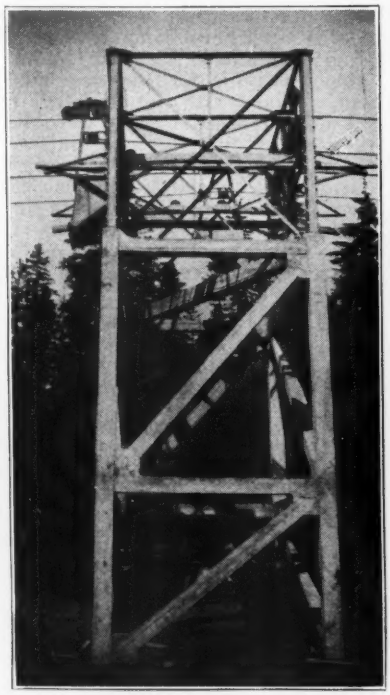
When the loaded buckets arrive at the unloading tram terminal, they are unloaded by an automatic trip that causes the bucket to drop its load into a hoppered chute leading to a Williams mill where the rock is reduced to 1½ inch maximum size. Arrangements have been made to trip the bucket at a point where it will dump the rock on to the storage pile in case it is desired to by-pass the Williams mill.

Inserted in the reinforced concrete tram terminal building are steel towers supporting the counterweights for the cables, which give greater resiliency than concrete and are desirable in this case.

An inclined belt conveyor carries the rock from the Williams mill and dumps it on to the storage pile directly over a tunnel which runs underneath the pile for its reclamation. Reinforced concrete piers form the supports for a craneway with an 80 foot span and 250 foot travel. An 11 ton Shepard crane equipped with a 4 yard Blax Knox bucket operates on this craneway, carrying the rock back to storage from the pile under the belt discharge and keeping it segregated for mixing in the proper proportions when fed to the belt leading to the raw mill. This crane clears the ground by 50 feet with a present storage capacity of 65,000 tons which can be doubled by extension of the craneway.

About half a mile from the mill on the railroad line to the quarry a clam shell bucket and derrick loads the clay for use in the mix into Western side dump cars which are handled to the mill by the engine. This pit is soon to be abandoned for a large one located just across the Baker River beside the main highway. The same loading apparatus now in use will load the clay into 5 ton trucks which will transport it to the wash mill which is located at the wet mill. Here the clay is dumped into a washer which reduces it to a slurry which is drawn off through a screen and elevated by a bucket elevator into 2 clay slurry

Aerial Tramway Supporting Tower



Reinforced Concrete Tower Supporting Tramway

tanks located above the grinding machinery.

The belt operating in the tunnel under the rock storage drops the rock on to an inclined belt conveyor which elevates it into a bin over the two

Loading Tram Terminal

Allis Chalmers ball mills and the vertical Hercules mill comprising the first stage grinding. The clay slurry is introduced into the Hercules mill only and is mixed with the discharge from the ball mills after being elevated into a trough over the tube mills where the slurry is kept in agitation by both compressed air and mechanical means. Two Allis Chalmers screens insure against large particles passing over. The slurry passes through three Allis-Chalmers tube mills each 6 feet in diameter by 22 feet in length, after which it is passed through three more tube mills of the same size. The six tube mills are lined up along one side of the tube mill room, along the other side of which are the seven finish tubes. A large hand overhead crane with two lifts is provided with access to each tube mill and its drive. Allis Chalmers, Bullock Westinghouse, and General Electric motors are used for operating the mills. Belt drives are used on the first stage grinding, and Link Belt silent chain speed reducers are used on all the tube mills. The building and bins are of reinforced concrete.

Elevated into a trough over seven of the eight slurry tanks, a screw conveyor carries the slurry to the desired tank. These seven tanks are used for correction, and the proper amounts are drawn off and elevated into the eighth tank which is the kiln feed tank. The slurry is elevated from here into a trough in which a Ferris wheel feeder for each of the six kilns operates. A pipe from the feeder leads the slurry into the feed end of its particular kiln.

There are 3—8x7x135 foot kilns and 3—9x8x192 foot kilns with a combined capacity for burning 4700 barrels of clinker in 24 hours. Each kiln is lined with Ashland fire brick. Number 6 kiln was put in operation for the first time on August 1st of this year. As yet they have not had time to construct a concrete stack for it and are using a steel stack temporarily. The short kilns have steel stacks as their permanent equipment, while the other two long kilns have reinforced concrete stacks 170 feet in height and 8 feet in diameter. Such a stack will be provided for Number 6 kiln as soon as convenient.

Foote gear reducers direct connected to variable speed motors secure the desired kiln rotation.

The burned clinker from the first five kilns is carried by an inclined bucket conveyor and dumped into the hot pit in the newly constructed clinker building which has a capacity of 120,000 barrels of clinker. A chain belt drag chain carries the clinker from Number 6 up an inclined trough and dumps it into the same hot pit. A 7½ ton Shepard crane operating on an overhead craneway distributes the clinker over the pile and reclaims it when needed for grinding. This crane also handles the gypsum into the clinker as used.

The Guard Net Under Tramway for City Streets

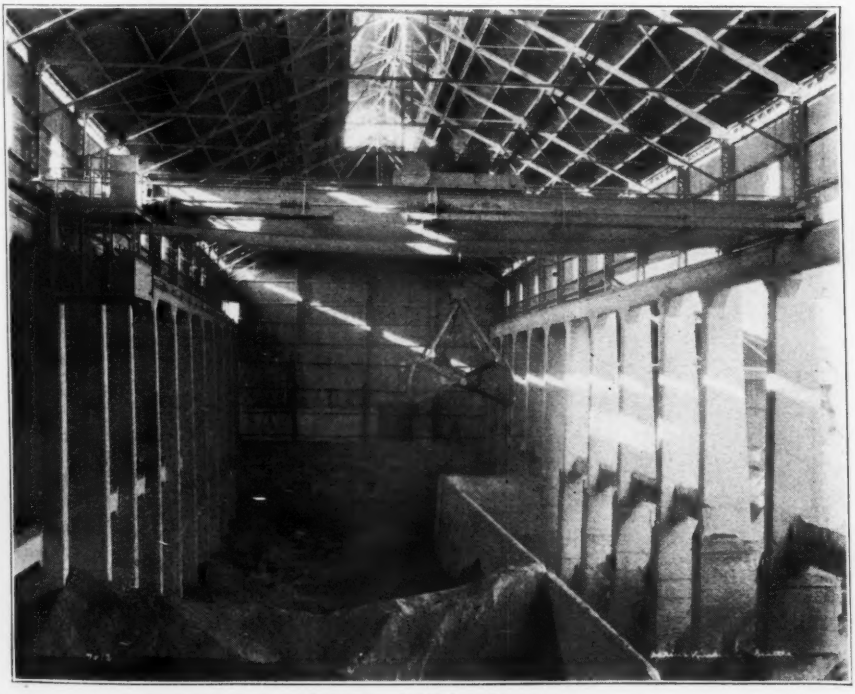
From the clinker storage the clinker passes through a 60x50 foot cooler and is given a preliminary grinding by two Hercules mills, and after elevating it is given its final grinding in seven Allis Chalmers tube mills of the same size as are used on the wet end. In one day 7000 barrels of cement can be ground.

A screw conveyor operating under the discharge end of the tube mills carries the cement to an elevator which raises it high enough to clear the railroad tracks and dumps it onto an inclined belt which takes it to the distributing conveyor over the stock house. Fifteen reinforced concrete silos, arranged in three rows with a total capacity of 100,000 barrels, are used for storing the cement until time for shipment. Screw coneyors under each row of silos carry the cement when drawn off to a cross screw which carries it under the railroad tracks to the elevator in the packing house which drops it into the screen over the packing bins. These bins are of reinforced concrete and are built as part of the reinforced concrete packing house.

Six Bates packers with three tubes each are used for sacking the cement. Arranged in rows of three each to one of the two belt conveyors which carry the sacks away from the packers two cars of cement an hour can be shipped, one on each track. Cyclone dust collectors carry off the dust from the machine operators and return it to the bins.

Slack coal secured from Bellingham is pulverized and used for burning the clinker. Arriving at the plant over the Great Northern Railroad in bottom dump cars, it is spotted over a hopper and dumped onto an inclined chain belt drag conveyor which dumps it into the outside storage area used for the coal. It is next taken to a coal dryer of their own construction; and after it is dried, it is ground to the desired fineness in four Raymond mills. The dust collector from the Raymond mills discharges into a screw conveyor which carries the powdered coal to the bins over the kiln feeders.

Double screw feeders are used together with air furnished by a Sturtevant fan. These fans discharge into a common head along the side of the coal bins from which the leads to the



Interior of Clinker Storage

kilns are taken off.

A large reinforced concrete machine shop is well equipped to do all work usually required in the operation of a large cement plant.

Electricity for operation of the plant is transmitted to the plant site by the Puget Sound Power and Light Compay at 60,000 volts and stepped down to 550 by them before turning over to the plant. The Cement Company has an auxiliary plant of its own on Bear Creek where it generates 2000 KW at 12,000 volts. This is used for plant operation as well as that purchased from the Power Company, and insures continuous operation of the kilns in case of trouble with the other lines. With the completion of the dam and power house on Baker River, they will have another source of power. Transformers in the Company's power house transform the 12,000 volt electricity from their Bear Creek plant to 550 volts for plant use. Two large Ingersoll Rand compressors, which furnish compressed air for plant use, are located in this building.

A commodious reinforced concrete office building with a laboratory in the basement completes the plant layout. The laboratory is especially well equipped and makes all of the required tests. Automatic Tinius Olson briquette testerm breakers grinders, a small tube mill, a 200,000 Number Tinius Olson compression machine, a hand operated Climax concrete mixer, and a machine for making an air analysis to determine the grading of the cement which passes the 200 mesh size comprises some of the equipment. Just outside the laboratory is a small kiln for use in making experimental burns.

A Koehring caterpillar crane for use either with a clamshell bucket or shovel is used for work around the yard.

The Superior Portland Cement Company, a few years ago, absorbed the Washington Portland Cement Company which operated a cement plant about half a mile from the Superior plant. The Washington plant has been salvaged and partly accounts for the many makes of motors used in the plant which we have described. This plant originally using the dry process in wooden buildings will soon be among the best. There is a good demand for their product which is of very good quality. The average tests so far this year show as follows:

Mix	Test	7 day	28 day	Shape
1-3	tension	283	372	standard b
1-3	compression	2090	3735	2"x4" cylinders
1-2-3	concrete	1450	2462	6x12 cylinders

The officers of the Superior Portland Cement Company are: John C. Eden, President; James R. Stirrat, Vice President; S. L. Barnes, Secretary; A. A. Sutherland, Treasurer; Gordon Tongue, Sales Manager; William Jennings, Manager; C. L. Wagner, Superintendent; W. J. O'Connel, Purchasing Agent; H. A. Ambler, Chemist. The Seattle offices of the Company are in the Seaboard Building.

Looking Down on Tramway With Guard Net Below

Gypsum—Quarrying Manufacture and Uses

By George O. Gray

Part I

This is the first part of a paper by Mr. Gray, assistant sales manager of the Three Forks Portland Cement Company, which was presented before the Seattle Mining Club of Seattle, Washington, on July 22, 1925. The second and last part will appear in the October 1st number of Pit and Quarry.—Editor.

PREPARATION of this paper necessitated drawing on all of the available sources of information, interpolating and rearranging various articles of authorities for the sake of brevity.

The use of gypsum in the arts is recorded in the earliest monuments of civilization. Its value was known to the pyramid builders of Egypt and to the artists who wrought during the eighteenth (1580-1350 B. C.) and later dynasties.

The origin of gypsum still remains a question, some students advance the theory that it is derived from limestone by the action of sulphurous waters resulting from the oxidation of pyrite and other sulphides. Others claim that most deposits have been formed directly from sea water under conditions favorable to evaporation.

In 1910 F. L. Hess grouped gypsum deposits in four classes:

1. Efflorescent deposits
2. Periodic lake deposits
3. Interbedded deposits
4. Veins.

R. W. Stone adopted a similar classification for gypsum deposits derived from solution. He further adds:

5. Deposits produced by alteration
6. Deposits produced by disintegration and mechanical reaccumulation.

Gypsum is one of our softest minerals; it is found in most countries, but there are no known deposits within the State of Washington. It is known as "selenite," "satin spar," and "massive gypsum"; all alike in their specific gravity, in hardness, and in solubility.

Gypsum is chemically known as "anhydrous calcium sulphate," with a formula $CaSO_4+2H_2O$; when pure, gives the following constituents by weight in percentage:

Lime	(CaO)	32.6
Sulphur trioxide	(SO_3)	46.5
Water	(H_2O)	20.9

Impurities sometimes found are:

Alumina
Iron oxide
Silica
Magnesium sulphates
Sodium sulphates
Magnesium chlorides
Sodium.

Alumina, iron oxide, and silica occur in many deposits, while the sulphates and chlorides of magnesium and sodium are rarely found. The presence of iron oxide changes pure white to grayish white. A small percentage of silica increases the plasticity of the finished product and does not affect its strength. The sulphates act as accelerators; while the chlorides will cause plaster to soon deteriorate. Owing to the hygroscopic nature of chloride salts moisture is absorbed from the air and taken up by the plaster, which rehydrates to the dihydrate.

The characteristics are: Hardness 1.5 to 2.0 Moh's scale. Specific gravity 2.3 to 2.4. Color white, gray, brown and pink. It lacks the greasy feeling that characterizes other soft minerals, like soap stone, talc, and graphite. Somewhat soluble in water, one part gypsum to 360 to 452 parts of water, varying according to the temperature of the water. Solubility increases more than three times by the addition of sodium chloride, and four times by magnesium chloride.

SELENITE often occurs in distinct crystals, which belong to the monoclinic system, it is generally colorless and transparent to some degree, in many cases completely so. Cleavage is perfect, it splits into thin sheets like mica, but lacks flexibility, and crumbles under heat.

SATIN SPAR is deposited by precipitation taking the form of long slender crystals, generally white, with silky luster.

MASSIVE of ROCK gypsum occurs in large bodies, varying in thickness from a few feet to one hundred feet, pure white color is common, grayish white is more abundant, while browns, and pinks are rare. The crystals, in texture, vary from fine to coarse. In structure the deposit may show distinct bedding planes, or it may occur

as a compact body. Massive gypsum, white in color, crystals fine in texture, is sometimes called "alabaster" and is used for statuary, vases and ornamental slabs.

GYPSITE consists of small detached crystals of gypsum scattered throughout fine clay or loam so abundantly that they form from eighty to ninety per cent of the entire mass. It occurs as extensive surface deposits in several of the western states. It is found in forms as powdery as wood ashes, to slightly consolidated. The color is usually gray, mottled with white, buff, pink or red.

The geological explanation of gypsite is that this mineral is derived from primary deposits through the circulation of ground water. Water percolating through a gypsum bed dissolves a certain amount of rock which it redeposits by evaporation. Gypsite deposits are sometimes found directly above the primary deposits; it appears that in these cases that the water came up through beds of rock gypsum and formed gypsite on the surface.

ANHYDRITE is a mineral closely related to gypsum chemically and in point of origin. Gypsum under certain conditions is changed into anhydrite while under other conditions the opposite transformation takes place. Chemically, anhydrite is gypsum without water of crystallization and has for its formula $CaSO_4$. Its harness is 3.0 to 3.5 Moh's scale. Specific gravity 2.9. Color generally white, with a bluish or grayish tinge. Its texture is commonly fine granular, though fibrous masses and orthorombic crystals with three good cleavages are found. Chemically pure anhydrite contains 58.8 sulphur trioxide (SO_3). It occurs in distinct beds and in some cases appears as lenses in gypsum destroying the value of gypsum for plaster making, or as a retarder for cement.

To determine the presence and amount of anhydrite in gypsum a petrographic microscope is used. The low hardness, very perfect cleavage, indices of refraction, rather low birefringence, and large extinction angles readily characterizes gypsum; while anhydrite is distinguished by its cleavages, its indices of refraction, its bright interference colors, and its parallel extinction. The quantitative estimation under the microscope of anhydrite in raw gypsum is especially important as the chemical analysis cannot be used to determine the amount of anhydrite, owing to the variable water content.

Quarrying and Mining

The quarrying of gypsum consists: first, in the stripping of the deposit of its over-burden, then by drilling from the top more rock can be removed per shot. Using steam shovels for loading into cars, or conveyors, keeps the costs below that of mining. It has its disadvantages in the possibility that the over-burden may be come mixed into the gypsum, also difficulties of wet weather.

Mining is employed when the gypsum is covered by an excessive over-burden, also when the beds dip strongly. In cases where flat lying beds of gypsum occur at the side of a hill it is necessary to drive adits into the face, while those covered with heavy over-burden are entered by shafts. Strongly dipping beds are mined by dropping an inclined shaft, with drifts running out from shaft makes stopping possible.

The most common form of gypsum mine is the "room and pillar" type employed in flat lying beds entered by shafts or inclines. The general layout of a gypsum mine calls for a main haulageway, connecting the various rooms. Also this same method is sometimes used on veins having a dip, by running different levels. Mules are used in many mines for hauling the cars along all, or part, of the way to the shaft or incline leading to the plant. Mule power, however, is gradually giving way to more improved methods. A gypsum mine is always wet, and, in many workings, the matter of drainage presents a considerable problem.

Sufficient rooms are opened to furnish the required rock capacity for supplying the mill. The rock is usually drilled with electric drills of rotary type drilling a hole 1½ inches in diameter and from two to eight feet deep. The center of the face is drilled V-shape and shot out first, the second row of holes are drilled slightly to the center, the last row straight in; the sides and roofs being shot to the center by delayed firing. All rock being broken to one man size, either by hammer or separate shots. Loading into cars is either done by separate piece or by hand shovel.

Crushing is usually accomplished by gyratory crushers, on account of their large capacities and low operating costs, altho a jaw crusher is sometimes

preferred when a steam shovel is used for loading as in quarrying operations on account of larger pieces. Another type coming into popular favor is the "single roll," as it is self feeding.

Manufacturing

Crushed gypsum is shipped to cement plants, in either open or closed cars, to be used as a retarder for cement, using about 2% by weight, varying according to the natural "setting time" of the rock from which cement is made. The gypsum must be of high SO_3 content, and free from anhydrite for this purpose.

The crushed gypsum for plaster purposes is passed into a horizontal cylindrical rotating dryer, which carries the rock continuously from the intake to the discharge and, during this period it comes in contact with direct heat, which evaporates only the surface moisture, thereby preparing the rock for grinding.

From the dryer the rock is conveyed to the grinding mill, which is either a roller mill with an air separation system, or stone buhrs. Due to the upkeep of the stone buhrs, on account of the necessity of hand dressing the buhrs, with the resultant delays, most mills have discarded this type.

The Raymond roller mill is now used almost universally as it grinds very efficiently, and, due to the air separation system used in combination a very uniform grinding is obtained. This mill consists of four or five heavy rolls suspended from a central shaft, and when the shaft is rotated the rolls through centrifugal force press against a broad steel ring. The rock is mechanically fed to the machine and by properly arranged blades or scrapers is kept crowded against the steel ring on which the rolls are rotating. A strong air current produced by a large fan carries away the fines to a collector where the coarser particles are separated and returned to the mill for further grinding. The degree of fineness is controlled by regulating the air current. The gypsum of approved fineness passes on to the storage bins.

This product is known by the following trade names: "uncalcined gypsum," "stucco," "land plaster," and "gypsum fertilizer."

Gypsum fertilizer, or land plaster, has proven itself over a period of many years use. Nitrogen, one of the most important, and certainly the most expensive form of plant food to purchase in chemical form, is effectively and cheaply supplied to the soil indirectly by the use of gypsum. The legumes are the hosts of nitrogen-secreting bacteria and respond tremendously to a sulphur fertilizer like gypsum.

Potash, which is abundant in most soils, and which, in insoluble form is present in even the first six inches of surface soil equal to the needs of hundreds of years, is made soluble without waste by the reaction of gypsum on the potash silicates. Professor Peterson at Wisconsin found that land plaster doubled the protein in alfalfa. Sulphur must be transferred into lime sulphate by chemical reaction in the soil, whereas gypsum, a neutral salt, is itself a lime sulphate.

Ground gypsum, when sprinkled over stable manure, changes the volatile ammonium carbonate into the non-volatile ammonium sulphate. In this way the valuable nitrogen compounds are preserved which are otherwise lost. Gypsum also checks the decomposition of the organic materials and humus in the manure piles.

Calcining

The calcining kettles are fed from the bins containing the pulverized gypsum. The kettles are hollow cylinders of boiler plate with convex iron or steel bottoms, having a diameter of 8 to 14 feet, and a height of 6 to 10 feet, with a capacity of about 12½ tons of crude ground rock, in the large size kettle.

These kettles, so called because of their shape and function, rest on masonry fire boxes, are surrounded by brick shells, and are heated by direct coal fire or gas. Paddles propelled by a gear driven vertical shaft keep the mass stirred between the flues and from the convex bottom of the kettle.

The top of each kettle is covered with sheet iron and is fitted with a small door for observing the contents, and a recording thermometer to check uniform firing and calcining.

Calcination is merely the process of heating the raw gypsum to a point where a part of the water of crystallization is driven off. A properly calcined gypsum would correspond to the formula $CaSO4 + \frac{1}{2}H_2O$, called a hemi-hydrate. Or in other words, 75 per cent of its original water content has been driven off. If all the moisture is taken from the plaster, the product would be useless, sometimes called "dead burnt."

The raw gypsum is slowly fed into

the kettle, which has a starting temperature of about 212 degrees F., the temperature is gradually increased over a period of about one and one-half hours to about 280 degrees F., remaining stationary about thirty minutes then suddenly advances to about 320 degrees F., with a corresponding settle of its boiling. This is known as "first settle plaster" and is now "plaster of paris," which would re-crystalize in a few minutes if water was added, in other words bringing it back into "rock state," as found in nature.

Some mills make a "second settle plaster," for pottery, casting, and moulding purposes on account of greater density and strength. This plaster lacks the fatty plastic nature of the first settle and is short working. By leaving the "first settle" in the kettle, it will begin to boil again at 325 degrees F. more violently than before. This it continues for about thirty minutes, then settles at about 390 degrees F.

From "plaster of Paris," casting, finishing, moulding, dental, and wall plasters are made by varying the fineness of the grinding and controlling the setting time.

The plaster of Paris is dumped into "hot pits," through double gates, located at one side in the bottom of the kettle. From the hot pits the plaster is conveyed and aerated at the same time, into the cooling bins, thence into the mixer, where the retarder and fibre are added for commercial plasters. It is then dumped into the sacker, where the plaster is blown into sacks through a valve located in one corner, in the bottom of the sack, which has been previously tied. Jute sacks are packed 100 pounds net, paper bags 80 pounds net. From the sacker the product is loaded directly into cars for shipment. It is never warehoused at the mill.

The "setting time" is controlled by the addition of "retarder," a product of slaughter houses, made up chiefly of hair, caustic soda, and lime.

As "fibre" some mills use "sisal fibre," others long cattle hair, which holds the plaster together as a binder, until it "sets" upon the wall. Another fibred product is "wood fibred plaster," fibre generally made from cottonwood, used where the quality of sand is poor, and it is generally not sanded.

The setting time of plaster at the mill is very important, as the plaster must not crystallize until it is placed; for if any attempt is made to mix or apply plaster after it starts to "set up," the crystals are broken off, resulting in weak walls. The average "setting time" is about seven hours at the mill on commercial wall plasters, but when mixed with sand the time is accelerated to about four and one-half hours, provided the sand is clean and coarsely graduated, the water pure, and mortar box and tools clean.

On the other hand, if the plaster is too slow setting it may dry out, resulting in white soft spots, and checks, unless precautions are taken by the mechanics to cover all openings while the plaster is being applied; as one-half of the water used in the mixing is known as "mechanical water," and the other half is necessary for complete recrystallization.

The crystallizing of gypsum plaster consists of the forming of long slender crystals, darting out in all directions, interlocking with each other into a basket weave around each particle, binding them together enmasse.

I have described the "kettle process" somewhat in detail; for most mills use this method, but there are a few mills using what is known as the "Cummer" process, consisting of a rotary kiln, somewhat similar to that used in the manufacture of cement. The uses of gypsum will be discussed in the next article.

American Cable Appoints

The American Cable Company has appointed the well known firm of Bruntons, Musselburgh, to handle its general line, including Tru-lay wire rope and Tru-loc fittings, in Scotland. The Dominion Wire Rope Company, Montreal, is a new Canadian distributor. Other new distributors are: The Marion Machine Foundry & Supply Company, Marion, Indiana; J. Shuman Hower, 106 Foster Building, Utica, New York; The Contractors Equipment Company, 8 Steuben Street, Albany, New York; and John C. Louis, 221 South Eutaw Street, Baltimore, Maryland.

The Marion Steam Shovel Company announces the opening of new offices at 270 Pine Street, Portland, Oregon, Phone Broadway, 5140. Mr. Z. A. Toye of H. J. Armstrong Company, Seattle, is in charge and is in a position to carry out the Marion service policies.

Oregon's First Modern Cement Plant

By E. D. Roberts

CEMENT manufacture in Oregon really commenced with the construction of the plant of the Oregon Portland Cement Company at Oswego, Oregon. This location is ten miles from the heart of Portland. The project was poorly financed at first, and construction was held up for some time. Operators of British Columbia cement plants became interested and arranged for the necessary finances. Mr. L. C. Newlands was placed in charge of operations as Vice President and General Manager. Construction was resumed, and a one kiln plant was completed in 1916.

The plant was laid out with provision for a two kiln installation. Foundations for a 175 foot kiln were in place with 4 bearings. It seemed at this time that a 210 foot kiln would be more economical, and an additional bearing was placed giving the present kiln 5 bearings. A few other changes were required and made, but in general the original ideas of the Cement Engineering Company of Los Angeles, who designed the original plant, were carried out.

Portland has always been a very good market for cement, but has been without a plant of her own or the raw materials for the manufacture of it. Plenty of shipping facilities were available, however, and labor could be easily secured at all times.

Fifty miles up the Willamete Valley on the lines of the Southern Pacific Railway, a deposit of easy grinding cement rock was found which, when mixed with lime rock from a deposit at Roseburg, made an ideal cement.

Lime rock and cement rock arrive at the plant in bottom dump railroad cars which are spotted on an inclined track running over a reinforced concrete hopper into which the rock is

Airplane View of Oregon Portland Cement Company's Plant. Note Employees' Club House, Tennis Courts and Baseball Diamond in the Foreground

dumped as required. The two kinds of rock are kept separate until fed into the F. L. Smidth kominuter. The rock falls from the cars onto an apron feeder 4 feet wide which carries it over and dumps it into a number 20 Telsmith gyratory crusher which breaks it to a maximum of 2 inches in thickness.

The crusher discharges directly into the boot of a Link Belt bucket elevator operating in a steel casing which elevates the rock and drops it onto a distributing conveyor operating over a row of 10 reinforced concrete silos. Each silo has a capacity of 1,000 tons of rock. Additional storage of 7,000 tons is provided by setting the tripper at the junction of two silos and placing a deflector which causes the rock to fall to the ground along side of the silos. Cement rock is placed on one side and lime rock on the other. Hoppers, placed under these piles over a belt conveyor running lengthwise under each pile, reclaim this rock in the same manner that the belt operating under the silos does and carry it to the boot pit of the second rock elevator which discharges onto a belt conveyor which drops it into either the cement rock or lime rock bin as desired.

As originally laid out and installed, the rock was dropped into proportioning bins in a proportioning house. A car with compartments was spotted under the spouts of each bin in turn, and the proper amounts drawn off. When loaded, the car was dumped into the boot pit of the rock elevator which elevated it to the belt conveyor mentioned above which dropped it into the kominuter feed bin. Four of these bins had been provided, so a tap was made in the one adjacent to the present kominuter bin and a chute to the kominuter was installed with a rocker arm feed placed in this chute and geared to the feed on the kominuter. Both these feeds are of the F. L. Smidth rocker arm type. Water is added to this mixture of rock as it enters the number 85 F. L. Smidth kominuter which grinds the rock to a maximum which will pass the number 20 mesh screen.

A bucket elevator elevates the kominuter output to the top of the raw grind building where it is run through a Hummer screen which keeps all material that will not pass a number 20 screen from passing onto the tube mills and returns it to the kominuter by a chute for regrinding. The original installation provided a trix for this separation but was lately replaced by the Hummer screen. The trix will be kept in position for standby use. Tests have shown that a maximum of 9 per cent of fines is returned to the kominuter by this new method of separation. A special motor generator set was provided for the screen operation having a 15 cycle turn.

A Lenox drive connects each tube mill with a 200 H.P. Westinghouse motor. The tube mills are of the short F. L. Smidth type having a diameter of 6 feet and length of 12 feet. The slurry discharge from the tube mills falls into a screw conveyor operating over the correcting basins where the mix is controlled and the slurry kept in motion by F. L. Smidth mechanical agitators. These reinforced concrete basins are 18 feet in diameter and 8 feet deep and are built above and to one side of the mixing basin so that the slurry can be drawn from the correcting basins by gravity. The mixing basin is of reinforced concrete construction 14 feet wide by 21 feet long in the main part with semicircular ends and a depth of 17 feet. The mixing is done by three sets of paddles overlapping on each turn.

A bucket elevator raises the slurry to a chute which leads it over the main roadway to the kiln basin which is of the same plan dimensions as the mixing basin but 26 feet deep. A double leg elevator raises the slurry from the kiln basin to a tank kept at a constant depth in which the kiln feed operates feeding the slurry into the kiln.

As was stated before, the kiln is 210 feet long resting on 5 tires with a diameter of 9 feet except in the burning zone which is 10 feet. A 75 H.P. variable speed Westinghouse motor operates the kiln from a point near the center tire. The Vulcan Iron Works fabricated this kiln. No covering has been placed over the kiln although it has been provided for in the original plans. Ashland firebrick is used for the lining.

During the construction of the plant, some one secured an injunction restraining them from operating the plant on account of the dust nuisance. This was dismissed, but it was thought wise to forestall future trouble along this line. A chamber for a Cotteral Dust Precipitator was provided and equipped although it is not operated.

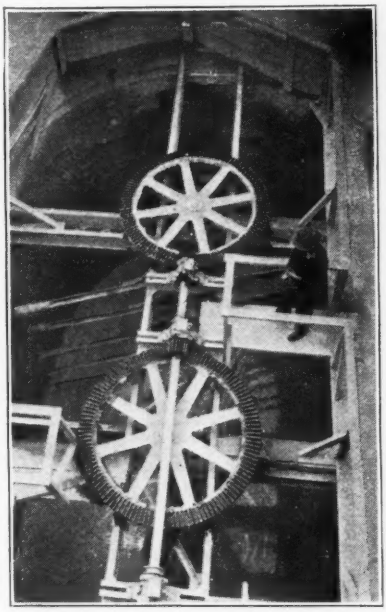
Considerable dust accumulates in this chamber, as it is, and is wheeled onto the clinker pile and later ground into cement.

Oil is used for burning the clinker introduced into the kiln by two 2 inch pressure atomizers using air compressed by a Connersville blower. Two blowers are provided to insure continuous operation. Arrangements have been made to replace these blowers with a General Electric centrifugal blower. A Babcock and Wilcox boiler heats the oil which is fed to the nozzle by a Worthington pump. The fuel oil is brought to the plant site by large oil barges and pumped into a 10,000 barrel storage tank placed near the firing end of the kiln.

The kiln operation has been very satisfactory, the output ranking very near the top for wet process plants. No trouble to speak of is experienced with rings, and a high quality product is obtained.

The clinker from the kiln falls through a passageway into a F. L. Smidth pressure cooler. The clinker passes from the left end to the right end in the center and part way back through a passageway around the outside of the inner shell. The cooling air is taken in at the discharge and reverses the travel of the clinker. Part of this heated air is used to fire the kiln, and the remainder is exhausted into the open air.

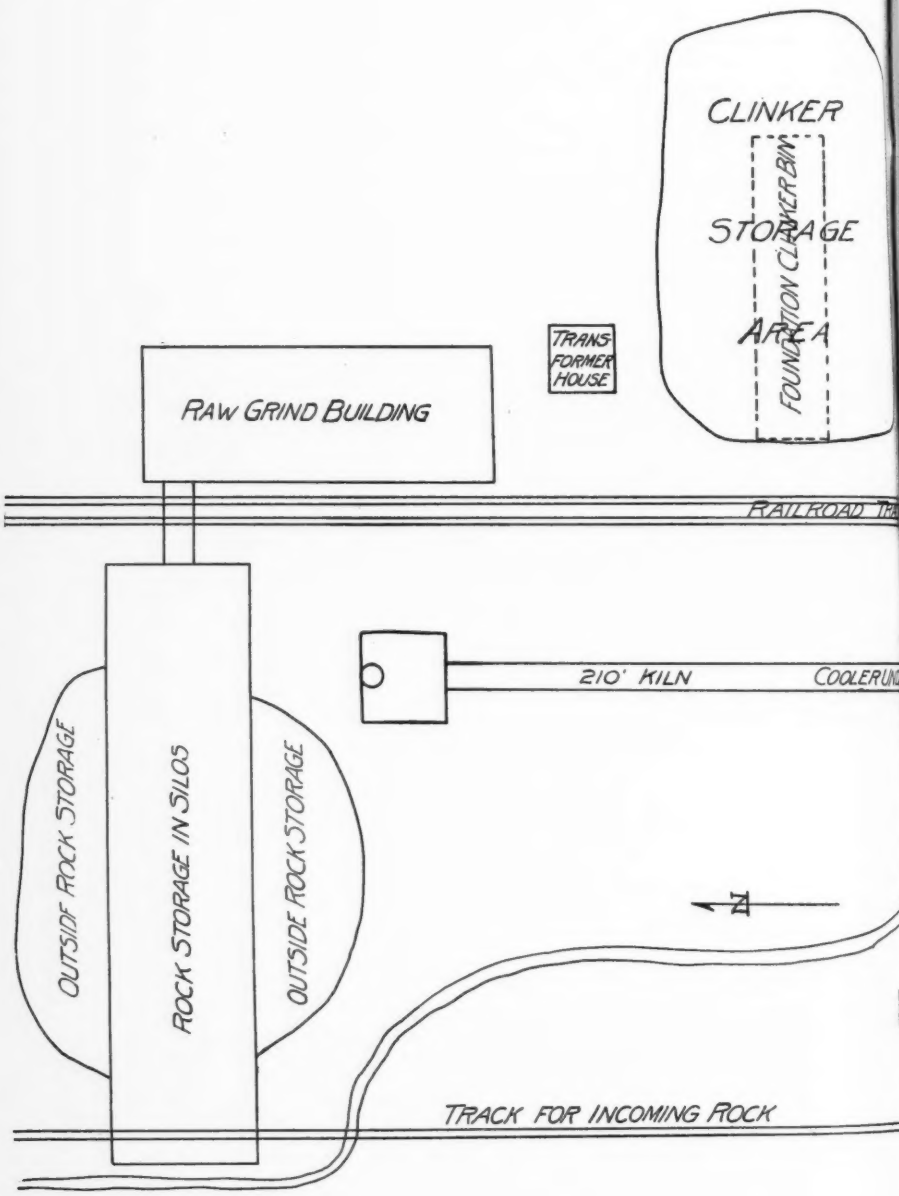
The cooled clinker falls into a trough in which a drag chain operates which carries it through a tunnel under the center roadway to the finish grind building. Chain belt chain is used for this purpose being the only chain in the plant that is not of Link-Belt manufacture.



Looking Down Into One of the Slurry Tanks

Foundations were provided in the original construction for a row of 5 clinker silos. These were not completed, and at present the clinker which is not ground at once is stored out of doors by a drag line scraper which reclaims it when required. A 40 foot dryer was provided for drying the clinker in case of necessity. The

The Storage Silos. The Machine Shop Is in the Right Foreground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ROCK STORAGE IN SILOS
OUTSIDE ROCK STORAGE
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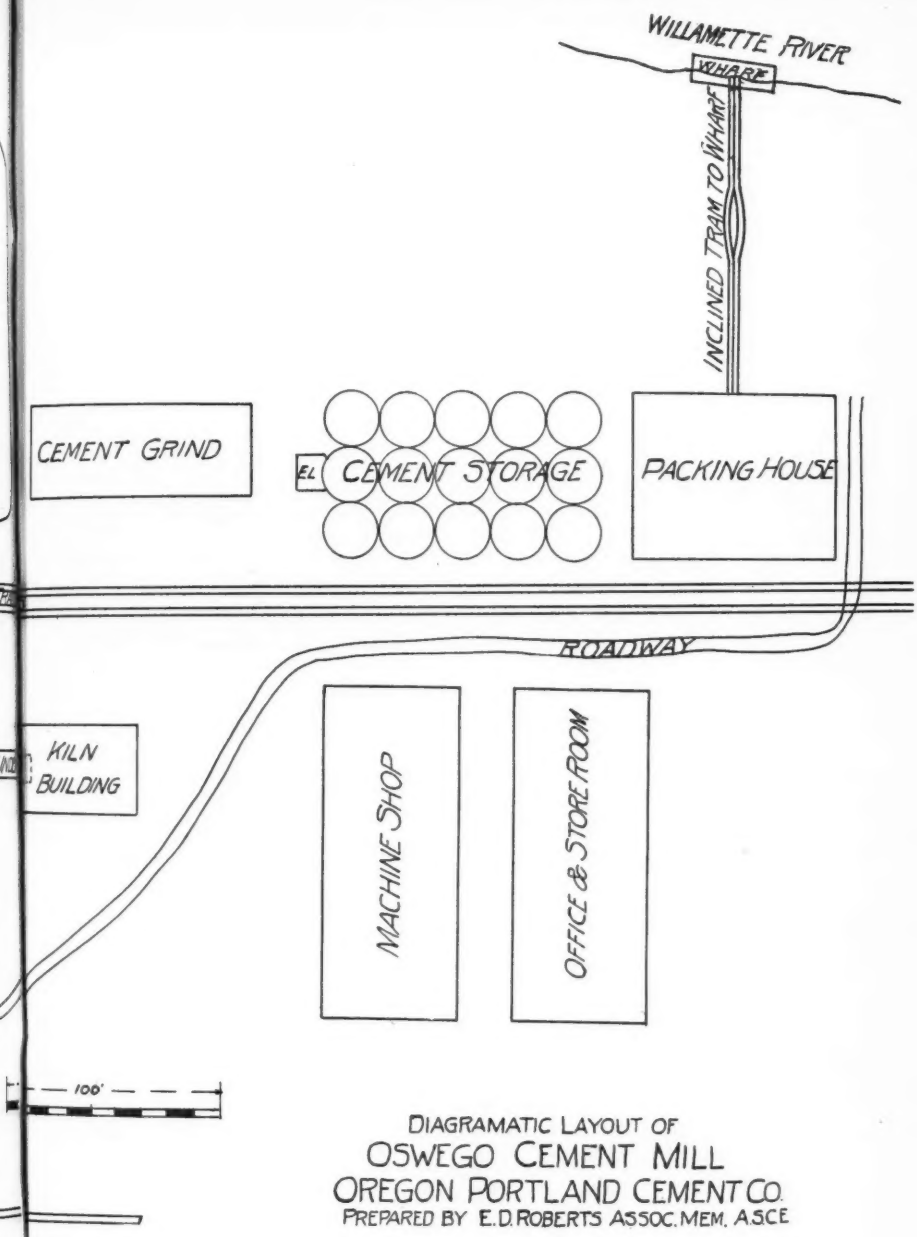


DIAGRAMATIC LAYOUT OF
OSWEGO CEMENT MILL
OREGON PORTLAND CEMENT CO.
PREPARED BY E.D. ROBERTS ASSOC. MEM. A.S.C.E.

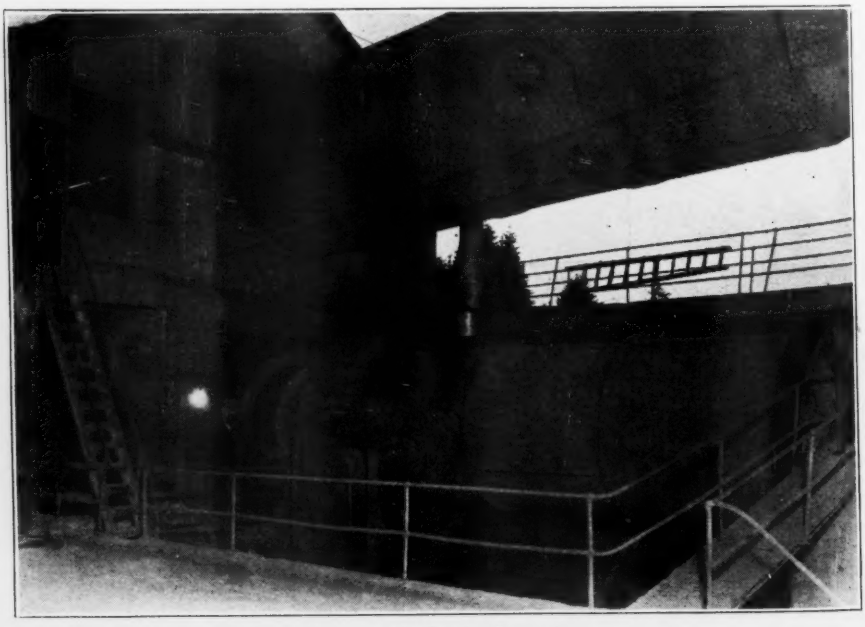
clinker grinds very well without drying, and this expense has been saved. This dryer was salvaged from a war time nitrate production plant in British Columbia where it was used for drying kelp. A car operated in a tunnel brings the reclaimed clinker to the boot pit of the clinker elevator into which the proper proportions of gypsum are dumped before elevating to the clinker bin over the dry kominuter. A hoist furnishes the power to pull this car to the elevator, and it returns by gravity for another load.

The discharge from the kominuter is conveyed and elevated to the tube mill bin directly over the 6 x 22 foot dry tube mill where the finish grinding is done. A 150 H.P. motor operates the kominuter while a 250 H.P. motor has been provided for operation of the dry tube mill.

The finished cement falls into a screw conveyor which carries it to the storage house elevator where it is elevated to the distributing conveyor operating over the top of the 3 rows of silos. These silos are of reinforced concrete circular construction with a capacity of 50,000 barrels of cement.

The cement is drawn off from these silos by taps in the bottom controlled by a slide valve. Falling into the conveyors constructed the length of the silos, it is carried to the packing house elevator which drops it into a screen which eliminates all tramp iron and foreign materials of any size from the cement. A screw conveyor carries the screened cement to bins placed over the Bates packers. There are 2 three sack packers installed and operated. The filled sacks fall onto a chute to the trucker who places them on his truck and wheels them to the car or truck as desired. Considerable demand is experienced for truck shipments which run better than a thousand barrels per day at times. An inclined track has been provided to the loading dock on the Willamette River over which a car is operated carrying the cement to load barges which transport considerable cement to various construction jobs along the water front and in the channel. The sacked cement from the packers slides directly onto this car. A patching machine, sack cleaner and tying machines constitute the additional equipment of this department of the plant.

All power for the operation of the plant is electricity which is received from the Portland Electric Power Company at a pressure of 60,000 volts and stepped down to 440 volts in the power house. There are 2 Westing-



Pressure Cooler in Operation

house 1,000 KW 3 phase water cooled transformers placed in the power house. All of the power house equipment is of Westinghouse manufacture. Gauges showing the power used in each department of the plant are conveniently placed for observation of the electrician. Power is purchased based upon the twenty minute peak demand. As a consequence very close check is kept on the total consumption by means of a recording meter. If the consumption runs up for some reason for over 15 minutes, the electrician will shut down some machine which does not have to be operated continuously, thus controlling the peak charge. Considerable money is saved in this manner.

Distribution of power to the various departments is made through a reinforced concrete tunnel running the length of the plan site. This tunnel is large enough for the passage of a man to clean the wires in safety and permits access to the wiring in case of trouble.

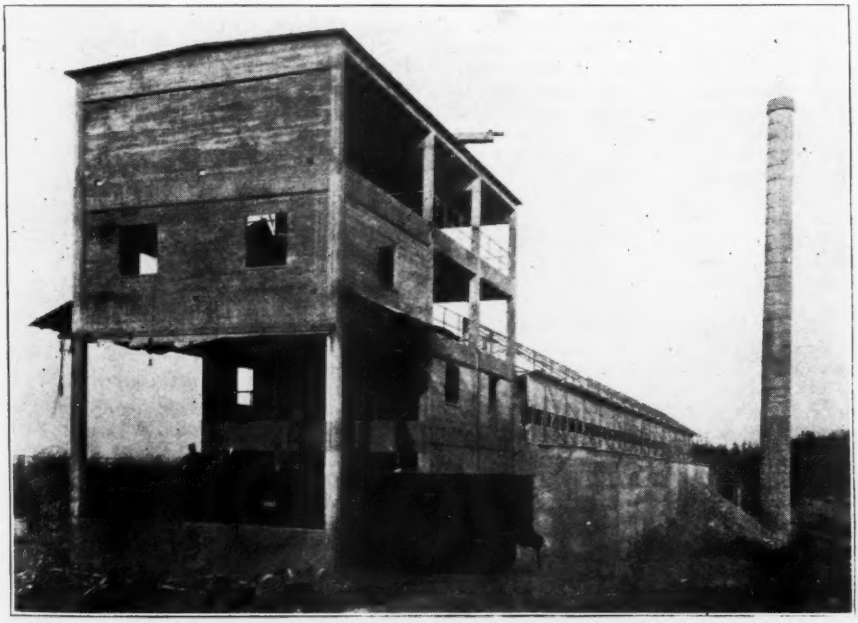
Auxiliary power is brought in from Oregon City at 2300 volts to provide for continuous operation in case of trouble on the 60,000 volt line. Both lines are owned by the Portland Electric Power Company but come from different generating plants.

All electrical equipment, with the exception of two motors furnished by Allis-Chalmers and placed recently, was furnished by the Westinghouse Manufacturing Company. Speed reductions are made by belts and gears. Silent chain reduction will be installed in one or two places in the near future.

The application of high pressure lubrication is now being made to this plant with good results. Dot high pressure lubricators, manufactured by the Car Fastener Company of Boston, are replacing the old grease cups saving time in greasing and giving more positive lubrication.

Reinforced concrete construction has been used throughout, but in a few places the structures were not completed as originally planned. The kiln bulding and the raw grind building have been partially constructed. The extreme mildness of the winters does not require that all parts be housed.

A reinforced concrete office building and a similar building for the machine shop each 112 x 50 feet round out the plant. The machine shop is well equipped to handle all repairs required at once and to fabricate certain repair parts and changes in machinery.



Unloading Incoming Rock. The Rock Falls From Car to Hopper Which Feeds the Crusher

Within the office building are the store room and laboratory. Several innovations have been introduced among which are a 3,000 watt Bayonet hot water heater for making the accelerated steam tests and a Tinius Olson recording briquette tester. This tester is a great improvement over the old type requiring the weighing of the shot.

Tests made on the cement show that a large margin is provided over the 200 pound tensile strength requirements. An average in excess of 350 pounds per square inch is obtained.

The product is marketed under the trade name of OREGON Portland Cement. An excellent local demand has furnished a market for all the cement that they have been able to produce.

Electric and steam lines of the Southern Pacific Railway Company in addition to water transportation and the Portland-Oregon City paved highway insure a variety of means for distribution.

Mr. R. P. Buchart, of Victoria, British Columbia, is President of the company. Mr. L. C. Newlands, with offices in the Wilcox Building in Portland, Oregon, is Vice President and General Manager. Mr. Carl W. Gath is Secretary-Treasurer, and Mr. H. P. Davidson is sales agent. Mr. D. H. Leche is plant superintendent, chemist and purchasing agent.

One of the noticeable features of the plant is the provision for recreation of the employees. A well equipped clubhouse and gymnasium together with tennis courts and a baseball diamond have helped to increase the morale of the men. A yearly picnic furthers the spirit of loyalty and co-operation which is noticeable at this plant. The quarry operations of the Oregon Portland Cement Company will be discussed in the October 1st number of Pit and Quarry.

Revised Speed Reducer Book

Foote Bros. Gear & Machine Co., announce the publication of a new revised edition of the IXL Speed Reducer Book. This book contains considerable new engineering information pertaining to the solution of problems involving spur and worm gear speed reducers. It is also replete with illustrations, tables, formulae, practical problems and general information, of considerable interest to engineers and plant executives who have to deal with transmission gearing and speed reduction problems.

New Hydrated Lime Plant for Porto Rico

On Thursday, August 27th, Mr. Claude J. Jones, Superintendent of the Lime and Hydrate Plant Construction for the McGann Manufacturing Company, Inc., of York, Pennsylvania, sailed on the New York and Porto Rico Steamship Company's steamship, "Porto Rico," for Fajardo, Porto Rico. Mr. Jones will superintend the erection of a Schulthess Hydrate plant for Jorge Bird Arias, who is an operator of an extensive sugar plantation and who furnishes most of the lime for the Centrales and building operations in Porto Rico. Mr. Jones will not only superintend the installation of the plant, for which the McGann Manufacturing Company is furnishing the complete equipment, but he will also put the plant into operation.

The McGann Manufacturing Company, Inc., which recently secured the rights to manufacture and sell the Schulthess Hydrator in North and South America, is installing at the present time hydrate plants for the following:

Pierce City Lime Company, Pierce City, Missouri.

F. D. Barnhart & Sons, Mt. Pleasant, Pennsylvania.

Jorge Bird Arias, Fajardo, Porto Rico.

National Limestone Company, Naginey, Pennsylvania.

Blue Ridge Lime Company, Asheville, North Carolina.

George M. Bushey & Sons, Cavetown, Maryland.

Valley View Lime Company, Bellefonte, Pennsylvania.

All of the equipment for these plants is being manufactured in the McGann Manufacturing Company's shops at York, Pennsylvania. In addition to these seven plants there is one plant, the Limeton Lime Company, which is using the Schulthess hydrator and which has been in operation for nearly two years at Front Royal, Virginia. This plant was described in the May 1st number of Pit and Quarry.

California Diatomaceous Earth Marketed for Use as Admixture for Concrete

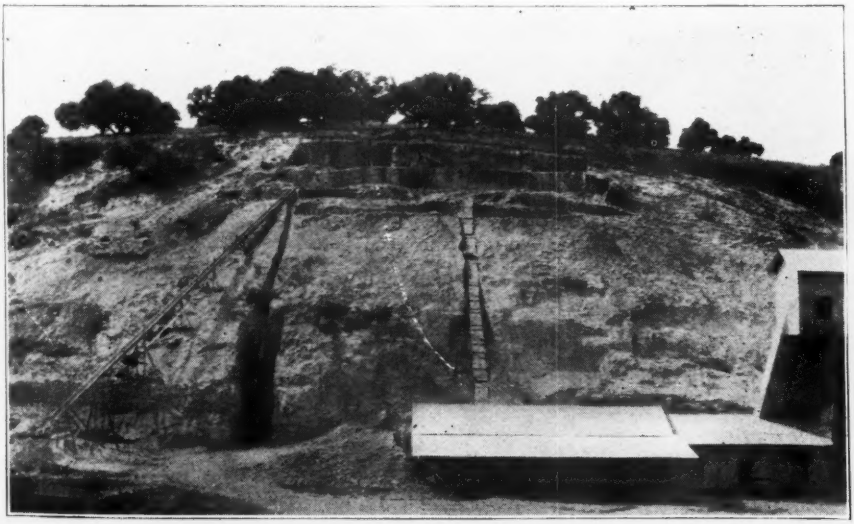
By H. W. Munday

DIATOMACEOUS earth, also known as kieselguhr, infusorial earth, fossil meal, fossil flower, etc., is composed of the siliceous remains of minute equatic plants known as diatoms, which necessarily have to be identified with the aid of a microscope. A cubic inch of diatomaceous earth contains 43,000,000 diatoms. There are many forms of diatoms; more than 8,000 forms have already been classified. Chemically, diatomaceous earth is a hydrous silica, but it generally contains a considerable quantity of earthy impurities.

This earth is quite widely distributed in the United States. There are known deposits in fourteen states. On the Pacific Coast there are known deposits in Oregon, Washington and California. In Washington it has been located near Seattle. In Oregon there occurs a deposit near Linkville, Klamath County, which has been traced a distance of 10 miles along Lost River. In California there are a number of deposits. The most important ones have been developed in Santa Barbara, Monterey and Orange counties. It is found also in Fresno, Kern, Los Angeles, Plumas, San Benito, San Bernardino, San Joaquin, Shasta, Sonoma and Tekama counties. During 1918 five operations in Monterey and Santa Barbara counties produced a total of 36,000 tons valued at $190,000.

There are many uses of diatomaceous earth. It is used as a mineral filler in plasters, cements, asphalt pavements, soaps, paints, inks, rubber, beauty clays, cleansers. It is also used as an absorbent for nitroglycerin in the manufacture of dynamite. It has great absorbent qualities as its specific gravity, bulk for bulk, is only one third that of water, i.e., 0.33. This quality makes it suitable for water filters. Liquids, chemicals and oils are filtered with the aid of diatomaceous earth. It is used with shellac in the manufacture of talking machine records.

Its uses abroad have been more numerous than in the United States. It has been used in Europe for the absorption of liquid manures so as to make the latter conveniently available as fertilizer. It has also been



Part of Deposit Being Worked at Present Time

used in the manufacture of water glass, in making cement, in tile glazing, artificial stone, ultramarine, and other pigments of aniline and alizarine colors, matches, papier mache, as a container for liquid bromine, and for miscellaneous minor purposes.

In California it has been used in the construction of buildings, advantage being taken of its property of being readily cut into any desired shape or size. In some of the California reports it is referred to as shale. It is easily quarried, and the small blocks into which it may be cut are light in weight and are easily placed in position.

A number of buildings have been successfully constructed of this material in the Lompoc district, Santa Barbara county, California. The blocks are compact and elastic under temperature changes and appear to possess sufficient strength. They are, moreover, very resistant to weathering on account of the insolubility of their chief constituent, silica. Such building material appears to be especially well adapted to regions of earthquakes or tremors, owing to the probable lesser effect of shock on such a light substance and the minimum amount of damage and danger resulting from its fall.

The Monterey Products Company of California has developed a diatomaceous earth known as Calatom for use as an admixture for concrete. When added to the mortar it produces a concrete which will not segregate,, is dense and more workable than other concrete.

Calatom as a mineral filler for plasters and cements is light in weight, increases suction, fattens the mortar and seems to make it stretch and finish better. It is water, fire and sound proof. It has a moisture absorption of 5 to 7 times its weight and gives off this moisture evenly, thus equalizing the set. It allows more sand to be used with gypsum plaster and makes lime mortar stretch and harden. It is not affected by any chemicals or oil but causes all calcined materials containing hydrated lime to set harder.

Calatom as an admixture for concrete has some interesting properties. With a 1-2-4 mix two pounds of Calatom are used for each sack of cement. When wet it lubricates the mass so that the stone and sand are more thoroughly and more readily mixed. It is added to the mix dry at the same time as the cement, sand and stone.

This product is 98 per cent through a standard 200 mesh sieve, and the greater portion is so fine that no instrument has yet been devised that will measure the fineness. Therefore it fills not only the voids in the sand and rock, but also the very cement

The Mill and Covered Storage Sheds

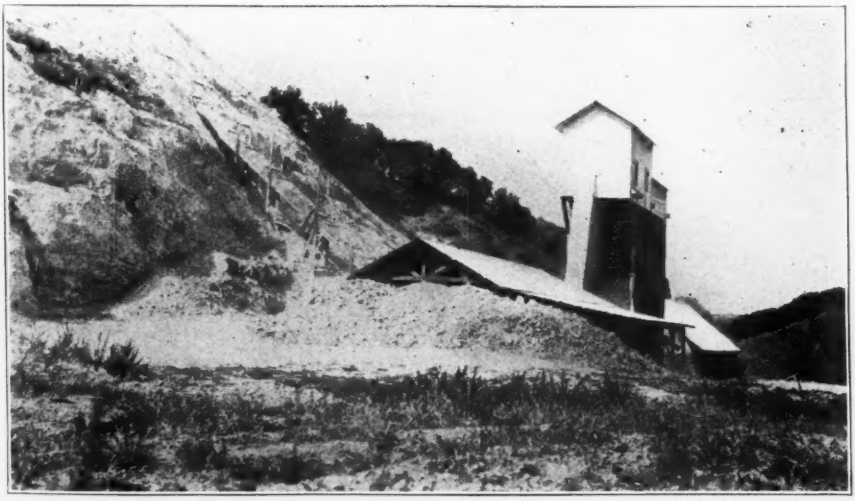
itself. Since the water which is taken into the mass is all held in the Calatom, after it has served its purpose and dries out, a small per cent of Calatom is left to fill the voids thereby waterproofing the the walls, as Calatom is 90 per cent pure silicate and is totally insoluble in water and therefore permanent.

As the water is held within the mass by the calatom, the mix slips from the buggy due to the lubricating by the calatom uniformly so that the entire mass is of the same mixture and uniformity. This gives the mass a slip as it is being placed in the forms. As the water is held by the calatom, leveling is facilitated and uniformity is assured. The mass goes farther in the form, and as the calatom holds all the free water moisture, the mix is just as uniform when placed in the form as when it left the mixer. This fact increases the strength of the concrete from 20 to 40 per cent. Concrete containing calatom can be dropped from a higher point than ordinary concrete without a trace of segregation.

The Monterey Products Company controls 3900 acres of different deposits of diatomaceous earth in Monterey, California. Monterey is located on the south end of Monterey Bay, 135 miles from San Francisco, and on the main line of the Southern Pacific Railroad. The diatomaceous earth probably runs to an average depth of 300 feet and totals somewhere between 7 and 10 million tons. The material which has been exposed to date is pure white in color and is of marine or salt water origin. About 43,000,000 diatoms are found to the cubic inch. The acreage controlled is partly covered with live oak. The overburden at the site of present operations varies from one to twenty feet in depth. This overburden is being removed by Fordsons. The earth runs in layers like the leaves of a book. The deposit slopes down from east to west 8 inches to the foot. The earth is very soft.

After the overburden has been removed, a small charge of low grade powder is used. The lumps broken up are handled by hand. The quarry is worked in ledges about 15 feet in width and from 10 to 15 feet high. The material when taken from the ground contains generally from 25 to 35 per cent moisture. This moisture is reduced as much as possible by natural evaporation. The drying of this material is a problem. The small diatoms seem to insulate each other. Even in artificial drying the outside of a piece dries and seems to form an insulation against the inner parts because they will be wet when the piece is broken open.

The quarried material is left in the air as long as possible. It is then sent down a chute to the receiving floor at the plant. Here two men load it onto a belt conveyor which delivers the lumpy material to a pair of roll



View Showing Mill and Also Product Stored in Open Waiting to be Milled

crushers. These crushers reduce all the material to two inches and less. A chain bucket elevator conveys the material to a double shell direct fired dryer. Oil is used for fuel. A 22 inch fan draws off the air and dust. The product is taken direct to storage bins from the dryer by a bucket elevator. The material is drawn from storage as needed by Link Belt feeders which deliver it to a K. B. hammer mill which is run at 3000 R.P.M. A fan removes the material from the hammer mill and discharges it to a separator where 25 per cent of the product is cut. The other 75 per cent is sacked by hand in eighty pound bags.

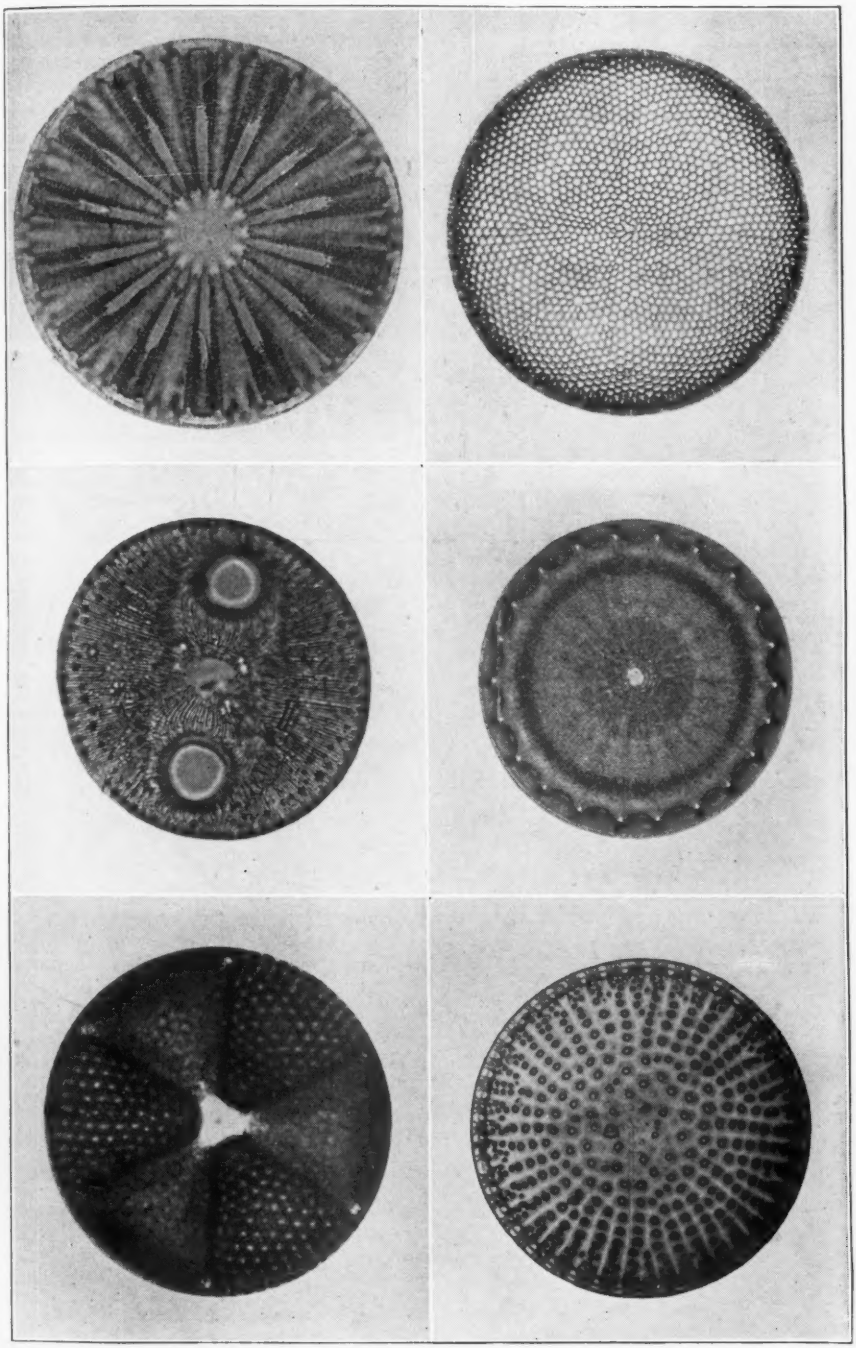
Shipments are made either by rail or water, and the product has to be hauled by truck from the plant to the railroad or dock. Rail shipments can be made over the Southern Pacific while the Monterey and Los Angeles Steamship Company hauls to San Francisco and Los Angeles where the product can be distributed again either by rail or boat. At the present time five men are producing 150 tons daily at the plant. Two more quarries will be opened this fall. Calatom is being used in about 90 per cent of the concrete work in Northern California. Mr. R. A. Brown is in charge of sales at Oakland, Calfornia. Sales offices will also be opened in Portland, Seattle and Los Angeles this month.

All Western Road Show

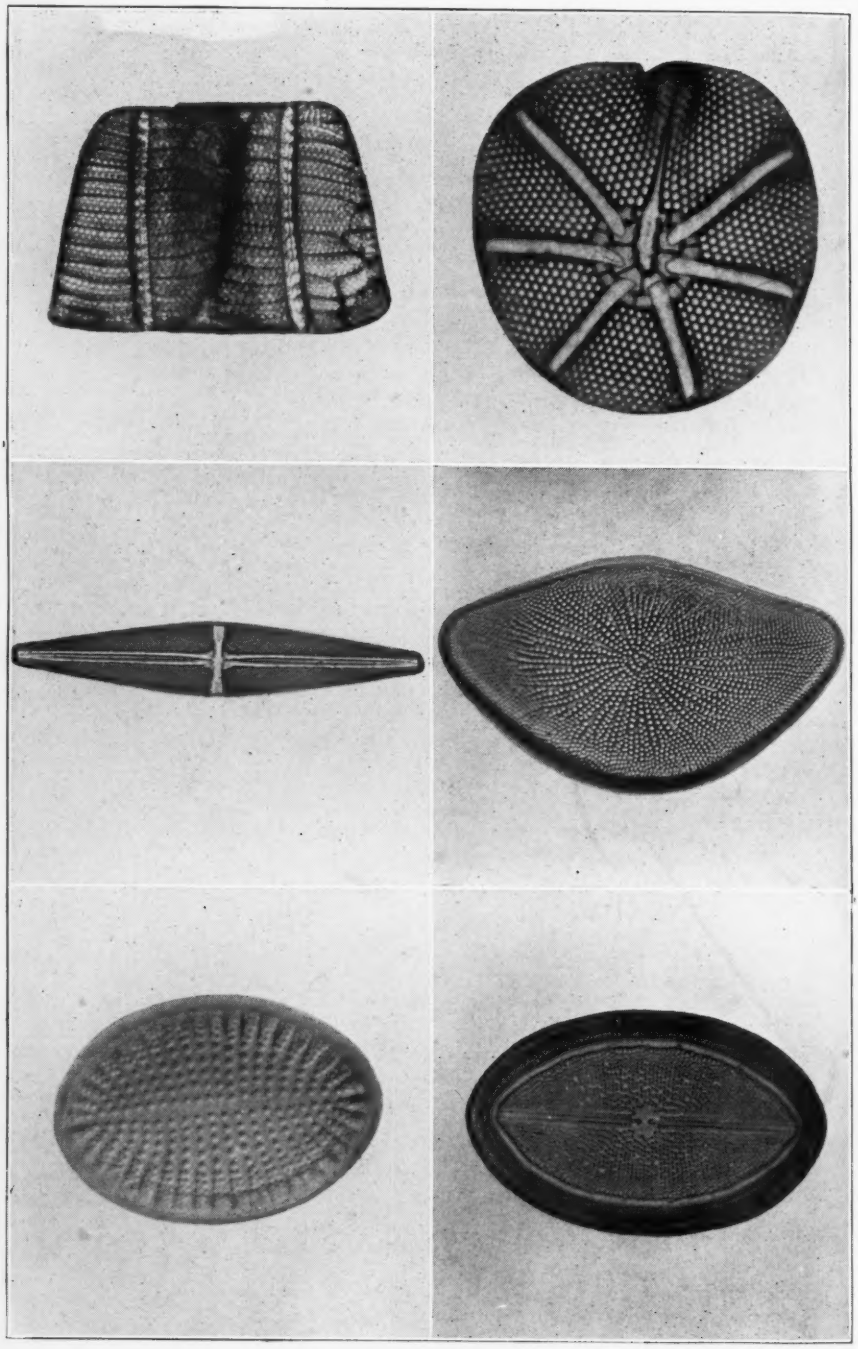
For the first time in history the West has invited manufacturers of road-building machinery and equipment to bring out samples and models of their lastest equipment for exhibition at an All Western Road Show, which is to be held in San Francisco from November 9th to the 14th. The exhibitions will be the last word in modern methods and advance engineering. Graders, shovels, pavers, mixers, finishers—everything used by the man who builds roads or provides the material which goes into the roads will be shown. There will be working models under canvas, and the larger pieces of machinery will be in action in ten acres of ground outside.

There will be a week of conventions. Visitors will be classified as engineers, contractors, county commissioners or distributors, and each group has a full day set apart for its own convention. Prominent speakers, selected by a program committee from each group, will lead the discussions. You will go away with many of your most vexatious problems solved. An entertainment committee is arranging a program in keeping with the occasion, a program which will include the ladies. The social features of the week will close with a banquet on Friday evening.

View Showing Portion of Deposit But Principally The Surrounding Country



Six Different Types of Diatoms



Six of Over 8,000 Classified Diatoms

California's Granite Quarry of Mystery

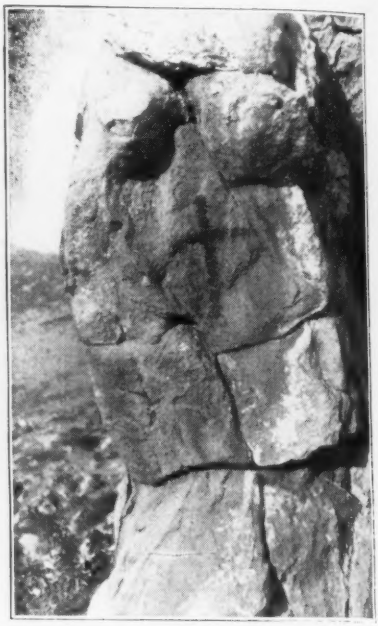
By H. W. Munday

MYSTERY and romance surround the new McKoon quarry at Santee, California. This atmosphere centers around a boulder snaped like a human foot, which rests above the quarry. This boulder has the sign of the Christian cross painted upon it. Chemists declare that this paint is human blood and that the cross was made at least a hundred years ago. One theory is that the padres who founded the San Diego Mission in 1769 knew good granite and may have marked the boulder for this reason. Then again an Indian believes that this may have been a mark made by his forefathers as a spot where they made medicine or prayed to their gods. There is an old legend linked up with this cross also. This legend is that the early church fathers buried gold dust, gold candlesticks, gold vessels, etc., from the San Diego Mission "near a rock shaped like a mocassin," in anticipation of the attack from Spanish troops about one hundred years ago. This actual burying is supposed to have been the work of four men who swore an oath of secrecy as to the hiding place of the treasure. This oath might have been sealed by making the "sign of the cross" in their own blood on a rock. Then again it might not. This atmosphere has helped to create considerable interest in the operations of the McKoon quarry, and Mr. McKoon, owner of the quarry, has made it an asset.

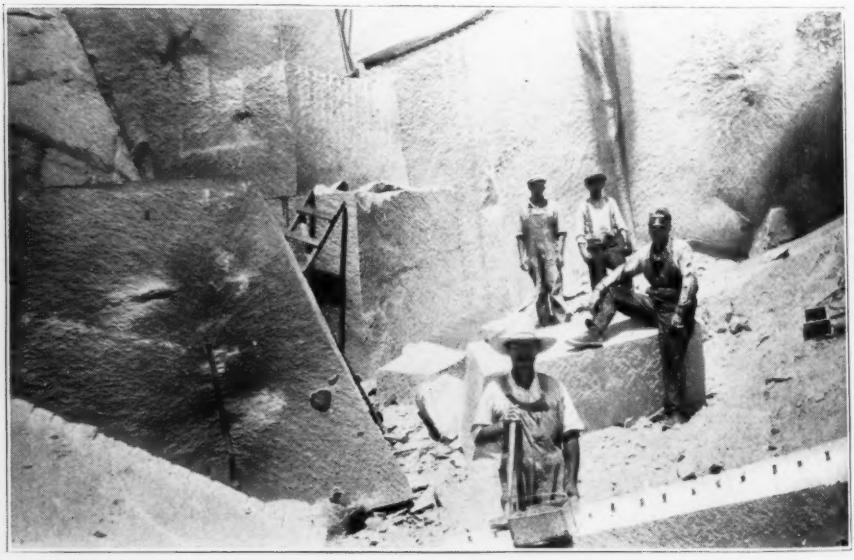
The McKoon quarry, of "Extra Dark Silver Gray Granite," is the only quarry of its kind in the United States. It produces a deeper blue stone than the ordinary "Silver Gray" which has been on the market for ten years. Granite dealers who have used many of the leading monumental granites in the United States are enthusiastic over this new "Silver Gray" and are using it in their most expensive memorials. It is adapted to sand blast work or the most delicate carving, leaving a clear edge. It is also excellent for statuary work. It takes a fine polish giving a soft rich blue color which is exceptionally plasing to the eye. The texture is even, and the grain is as fine as the

Hosmer McKoon Inspecting Some Granite

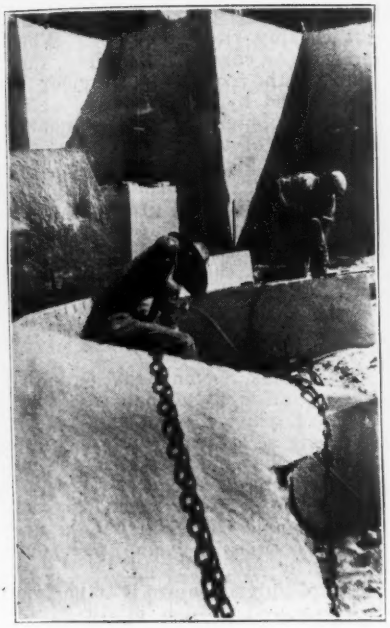
The Moccasin, Which Is Situated on the Very Top of Granite Ledge Where It Can Be Seen for Miles



A "Close-up" of the Moccasin Showing the Christian Cross, Which Is Located in the Low Center of Illustration

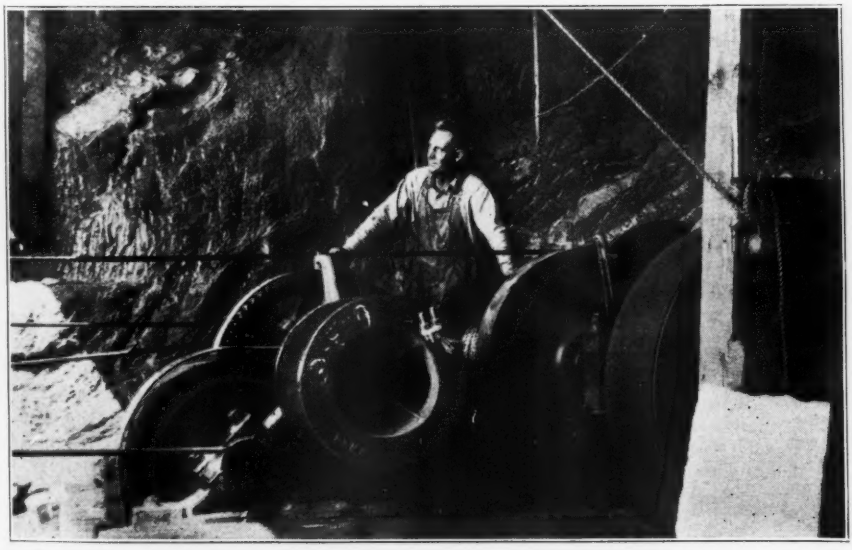


View Taken in the Quarry



Men at Work in the Quarry Trimming Granite Blocks by the Use of Air Drills

View Showing Ledge Method Being Used in Quarrying the Select Blocks of Granite



The Clyde Hoist With 10,000-Pound Single Line Pull and "Swinger"

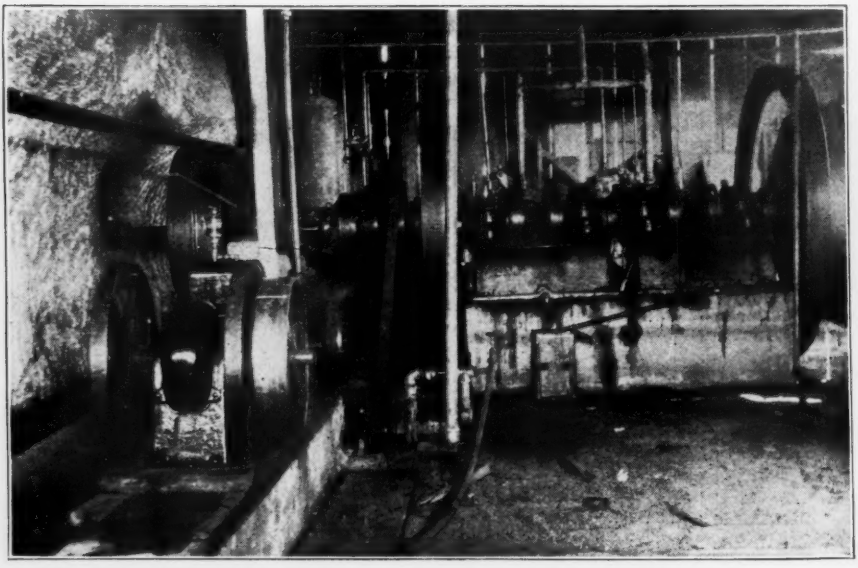
Approach to Plant

eastern statuary granites without the slight creamy tinge of color. When hammered or carved it is white, thus producing the contrasts in color so much desired by the trade.

The development of this new quarry is the result of the enterprise of one man, Hosmer McKoon, of Santee, San Diego County, California, who discovered this valuable granite on his premises and immediately invested over thirty thousand dollars after assuring himself that he had a large quantity of the stone and that it could enter the national market along with the best known granites of the country.

"Extra Dark Silver Gray Granite" does not suffer by comparison with any known granite. For this reason it is already sold throughout the western part of the United States, and inquiries are coming in concerning shipments to the Atlantic coast via the Panama Canal. The freight is actually less than to some parts of California by rail.

Chemical anlysis shows it to be free from compounds which might cause iron stains, and very high in strength and weather resisting qualities. This causes the great demand. The owner of the quarry has been rushed with orders ever since he began operations. There are two reasons for this: first,

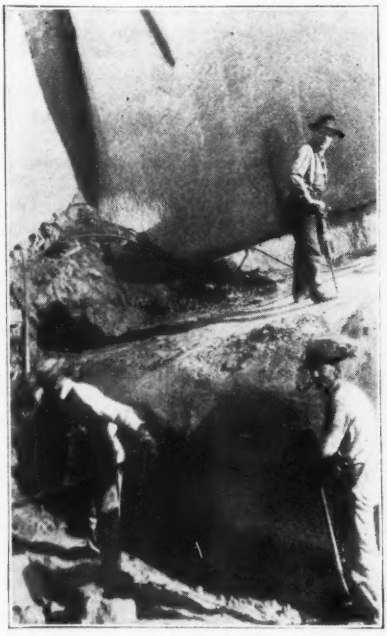


The 70 H.P. Full Diesel Type Oil Engine Which Performs as the Power Unit

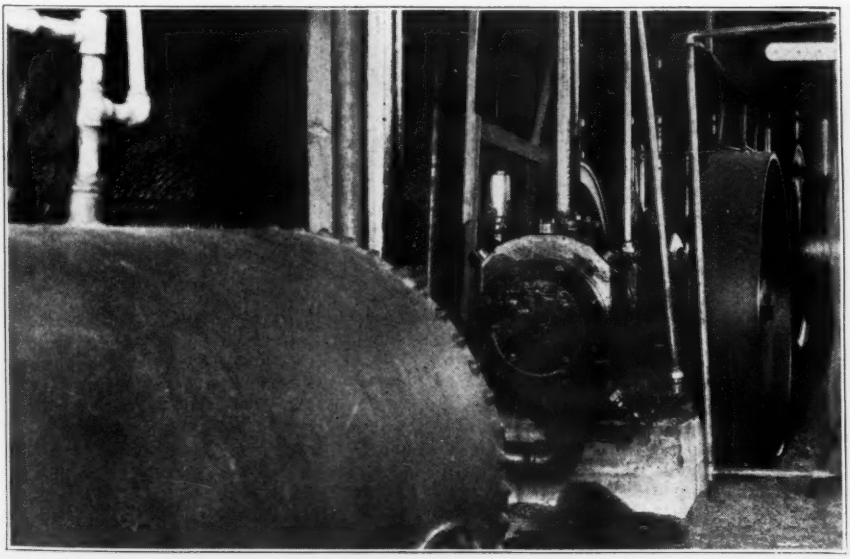
its deep rich blue color, together with its fineness of grain and evenness of texture; and second, its excellent splitting qualities, which enable the quarrymen to produce the finest shaped blocks for monumental and building purposes. This saves many dollars both in freight and in the finishing of the stone. Quarrying operations are carried on every month of the year on account of the absence of snow and the mild even climate of Southern California, which is rapidly becoming the granite center of the West.

Modern equipment has been installed in the plant, consisting of a Clyde hoist and swinging gear capable of handling a regular working load of twenty tons; a 101 foot mast and a 90 foot boom; and a 12x10 Sullivan compressor which delivers 248 cubic feet of free air a minute at 90 pounds pressure. The power unit consists of a 70 H.P. Fairbanks Morse oil engine of the full diesel type so arranged that the full power is available, at will, either for hoisting or for operating the compressor. For all ordinary loads both may be in operation at the same time, and a large air receiver will furnish air to the drills for ten minutes even when the compressor is idle.

Shipment is made by a Mack truck to the San Diego and Arizona Rail-



Another Quarry View



The Air Tank and Sullivan Compressor

road a few miles away, or to the city of San Diego when steamer shipments are desired. Since the supply of this excellent granite is unlimited, it is winning friends everywhere; and the business slogan of the management is, "Quality Makes Sales."

Upon the discovery of this wonderful and mysterious granite a few years ago by Hosmer McKoon, two problems presented themselves: power, and transportation down the hill on which the quarry must be situated. Electricity was only about two miles away, but the company demanded what seemed an unreasonable amount to install the power line and a very high minimum monthly service charge. It was therefore decided to install an oil engine with fuel at nine cents per gallon, delivered on the premises, and to arrange the shafting so that the full power of the engine could be used, at will, either for hoisting or operating the compressor. This was accomplished by a Whitman friction clutch between the engine and the belt running to the large Clyde hoist. The belt to the compressor runs at all times, but the hoist operator is able to turn the starting lever on the compressor, causing it to be idle and use no power, when the full power of the engine is desired to lift a 20 ton block of stone. Thus a 70 H.P. oil engine handles the service which would require two electric motors of about 75 H.P. each, with the ordinary "hook up" and does it at a cost of about $2.50 per day for fuel and oil.

The transportation problem was solved by a road down the hill, half a mile long. Originally there were curves in it which made it impossible for a truck to haul the hundred foot mast around them. This was accomplished by balancing the mast on a trailer, hitching mules to it, letting the ends of the mast project over the canyon at the curves and then pulling in the opposite direction like a railroad "switch back." Later, all but one of the curves were eliminated, and an easy down grade road runs from the quarry to the railroad. There the use of an electric hoist has been secured for loading the cars.

The problem of quarrying is, and always will be, very cheap and simple. There is no overburden of rock or soil to be disposed of, for the "Extra Dark Silver Gray Granite" is exposed on the surface for five hundred feet back from the edge of the cliff on which the quarry is situated. This makes it easy to keep two sides of the quarry clear.

At present the overlying boulders are being quarried, but they are of large size, for example, 19 feet wide, 19 feet high and 55 feet long. A 19x19 foot break was made by drilling a hole 5 feet 9 inches deep with the six point "rose bit" and using about a cupful of FFF black blasting powder. The third dimension of the block thus cut off was 12 feet, and an excellent break resulted on what is known to quarrymen as "the hard way." The Sullivan rotator is used in drilling the deep holes, and Sullivan plug drills and Pope's granite wedges split the stone to the sizes ordered by the customer.

The massive Clyde derrick irons on the derrick were chosen by Mr. McKoon because he liked the ball and socket construction at the base of the mast which prevents binding when all the guy ropes are not tight. Four of the derrick guys are 1⅛ inch galvanized Roebling yacht rigging and four are 1¼ inch on account of the extra strain to be carried. The safety factor is 500 per cent.

Other safety factors are a 10,000 gallon fuel oil tank which prevents delays on account of lack of fuel, a 3,000 gallon water tank with a circulating system for cooling the engine and compressor, a safety brake on the hoist, a Foamite fire extinguisher and a first aid kit. There is a reason for the compliment expressed by visitors that it is the best equipped granite quarry in Southern California.

New Equipment Company

The Hooper-Momberger Company has been formed by J. K. Hooper and C. W. Momberger for the purpose of conducting a general equipment business with offices at suite 1703, 90 West Street, New York. Mr. Momberger has for many years had a wide experience in design, construction, erection and operation of crushing and grinding plants. He has specialized in cement machinery and cement plants and was formerly connected with the Allis Chalmers Company, Power Mining and Machinery Company, and the American Smelting and Refining Company. Mr. Hooper has specialized for over fourteen years in all kinds of power equipment, including complete plants, electric, gas, air, hydraulic and steam lines, and contractors' equipment.

Lime—Quarrying Manufacture and Use

By Burton B. Pierce

This paper was presented on September 9, 1925, before the Seattle Mining Club at Seattle, Washington.

Mr. Pierce at the present time is conducting a consulting mechanical and electrical engineering practice in Seattle. He was formerly superintendent of the Sun Portland Cement Company's plant at Lime, Oregon, and previous to this with the Washington Portland Cement Company at Concrete, Washington. His training and experience fully qualify him to write on this subject.

Editor.

LIME in its most common form of limestone is found very widely distributed over many portions of the whole civilized world. It is one of the rocks which has for many years been quarried and utilized to a greater or less extent in very many of the localities where it occurs as its weight and bulk prohibit its shipment to very distant localities and make its production at the place nearest possible to where it is to be used very desirable from the viewpoint of first cost at the place of usage. Therefore it is quarried in large or small quantities depending on the demand in probably the most widely distributed localities of any rock.

Formation

Limestone exists in several forms, some of the more common of which are classified according to their physical characteristics as follows:

Crystalline Limestone.
Semi Crystalline Limestone.
Fossiliferous Limestone.
Shell Limestone.
Chalky Limestone.
Oolithic Limestone.
Sandy Limestone.
Cherty or Flinty Limestone.
Marl.

Crystalline Limestone; Marble is in this class and is a limestone which, through the action of heat and pressure, has become distinctly crystalline in formation.

Semi Crystalline Limestone; A hard, now rather compact limestone, originally soft and dense but afterwards recrystallized by the action of water. Frequently this recrystallization includes fossils within its mass, but sometimes the recrystallization is so complete that none of the original structure remains and the resulting material is hard, uniform and brittle.

Shell Limestone; A limestone composed almost entirely of shells or fragments of shell.

Fossiliferous Limestone; Any limestone in which fossil shells or other animal remains, such as bones, teeth, etc. are numerous and prominent.

Chalky Limestone; A partly consolidated limestone composed of microscopic shells.

Oolithic Limestone; A limestone made up of tiny nodules or concretions resembling the eggs or roe of a fish.

Sandy Limestone; A limestone which has been deposited near the shore so that much sandy material has been carried by the currents and incorporated in the main body of the material.

Cherty or Flinty Limestone; A limestone containing nodules or bands of chert or flint. This flint is composed largely of silica and the nodules have been segregated within the body of the limestone, probably by the action of ground water.

Marl; Marl is not a rock but comes under the same general head of calcium bearing deposits and is a soft, earthy mass, frequently covered by water and madeup of lime, clay, sand and carbonaceous materials, also shells and shell fragments in varying proportions and may have been formed in either fresh or salt water and is known accordingly as fresh or marine marl.

Composition

Limestone is composed mainly of calcium carbonate and any rock to be salable for any purpose except for aggregate or surfacing must contain from 75 to 95 per cent of cacium carbonate (ca Co3) and not over 4 per cent of magnesia.

Impurities

The most common impurities found in limestone are as follows:

Silica.
Iron.
Alumina.
Magnesia.
Sulphur.
Alkalies.

Colors

In color limestone runs from practically pure white, through many of the shades of grey, brown and blue,

to an occasional deposit almost black in color. Generally the white or black deposits are classed as marble but some deposits of lime have been found that were almost pure calcium carbonate and were white and hard to distinguish from quartz except by the acid test.

Texture

In texture limestone runs from a nearly pure rock of a very soft, crystalline mass up through the varying degrees of hardness to a highly silicious limestone which is nearly as hard as flint.

Quantities and Exposure

Limestone exists in various quantities in the different localities, from the huge, bald buttes or cliffs of limestone with exposures miles in length towering hundreds of feet in the air, to the hundreds of square miles of surface underlaid at no great depth by a sheet deposit hundreds of feet in thickness and with practically no outcropping, and to the humble, isolated "float" or small outcropping which occurs among many deposits of worthless rock and to quarry which necessitates an almost prohibitive expense for moving waste materials.

Quarrying

The methods of quarrying limerock vary according to the nature of the deposit, the topography of the surrounding country, the amount to be quarried per day, the amount of overburden or waste material to be handled, etc., and extend from the largest "open face" quarry with an exposed face perhaps miles in length and hundreds of feet in height, down through the smaller cut workings, the "glory hole" method of quarrying, the pit method, and the stoping method. Other quarries are simply large pits on the sides and bottom of which the rock is quarried and then raised to the surface by various methods of hoisting.

Open Face Method

In the open face method of quarrying the rock is either drilled from the top of the ledge and back a certain distance from the face and at a certain lateral spacing, by well drilling machines capable of boring a hole to the depth of the quarry floor, or large "coyote" holes or burrows are dug at various places along the bottom and sides of the face, or holes are drilled from the top with the proper spacing in both directions, with an air drill capable of drilling holes to a depth of about thirty feet, which last is called the "bench" method.

In either of these methods, when the proper number of holes has been made so as to be able to bring down the desired amount of rock, the drilled holes are sprung; that is, a small charge is fired in each hole to make an aperture at the bottom to hold a considerable amount of powder. Each of the holes is then loaded with the proper charge, the exploders are connected together and the holes are all fired at once by means of electric current from a blasting machine or electric lighting circuit connected with the exploders through wires extending to a safe distance.

This "big shot" brings the rock down to the quarry floor where it is further broken up by plug holes, and bull-dozers, which are small charges fired on individual rocks, and sometimes by the use of sledge hammers, to the desired size. It is then loaded either by power shovel or by hand into cars and taken to the crusher, loading bin or kiln as the case may be.

The "Glory Hole" Method

In the "Glory Hole" method of quarrying a tunnel is first driven into about the center of the deposit at the level from which the transportation should lead off. From the inner end of this tunnel a raise is driven upward at a slight angle to the vertical until it reaches the top of the deposit. Chutes with gates are installed just above the tunnel level to permit the rock being drawn out into cars by which it is conveyed to the storage bins or to the kilns direct.

The raise is then filled with broken rock from above and the quarry gradually is worked into a funnel shape. The rock is quarried all around the central raise by the benching method on about a 45 degree slope, it being drilled with holes quite close together and shot so as to break with very few large pieces. It slides by gravity, down the sides of the slope with very little handling to bring it to the mouth of the raise.

The Pit Method

In this method the rock is quarried at the bottom of a pit by the bench or open face methods and then raised to the surface by some type of hoist.

In quarries producing building stone, flagging, coping or large shapes of any kind no powder is ever used but the rock is cut around by a "channeling machine" which is like a large movable planer, and cuts a groove around the edge of the piece of rock

to be removed and then wooden wedges are driven behind the rock, wet and left to split out the piece by swelling. This is necessary as the use of powder starts invisible cracks which develop on finishing the stone and so it becomes useless.

The Stoping Method

This method is not largely in use as it is very expensive, but when it is used, it is carried on in the same way that is employed in stoping for coal or quartz. Tunnels are driven into the mass in the proper places, then the material is stoped out into chambers leaving pillars of the material to support the roof and taking out all the material except just enough for these supports. This is expensive as only small shots can be fired; cars must be loaded by hand; and ventilation is often a problem.

Manufacture

Limestone, when heated to between 800 and 900 degress centigrade, changes by the action of the heat from calcium carbonate (Ca Co3) to calcium oxide (Ca O), losing about 44 per cent of its weight which is driven off as carbon dioxide (CO 2) leaving behind what is known as quick lime. This theoretically requires 772 B.T.U. of heat per pound of limestone, and in actual practice would require from 110 to 162 pounds of coal at 14,000 B.T.U. per ton of limestone, or its equivalent in wood, hogged fuel, gas, or oil, plus probably about 100 per cent for radiation, improper combustion, and cooling while the lime is being drawn from the kilns.

The manufacture of lime by burning is carried on in three types of kilns; the vertical, the ring or chamber, and the horizontal types, slightly modified in form by different makers. The vertical kilns in general use are a cylindrical tube of steel enlarged at the bottom where the furnaces are, fitted at this part with two or more furnaces, lined with fire brick throughout and either open at the top or fitted with a stack through one side of which the raw limestone is dumped in charging the kiln, and having a drawing door at the bottom through which the burned lime is drawn at about 4, 6, 8, 12 or 24-hour periods, according as the production of the kiln is being forced.

The kiln is charged with raw rock at 6, 12, or 24-hour intervals from storage bins or directly from the cars or buckets that bring it from the quarry.

The fire and smoke from the furances together with the gases from the limerock rise directly through the whole body of unburned rock and dry and gradually heat it to the calcining point. These kilns are fired with either coal, oil, gas, cordwood or hogged fuel.

The ring type of kiln is much the same in form except that it has a chamber or enlargement part way up which serves to take part of the weight of the rock above it.

Some of the older kilns were a square chamber or hut of logs without a roof, built into the side of a hill so that the top was level with the ground on the upper side for convenience in dumping the rock from carts directly into the kiln. This hut was lined with brick and had two furnaces or arches built into the sides near the bottom, while on the lower side of the kiln at the bottom was built a drawing door through which was drawn the burned lime into a shed where the lime was barreled and stored for shipment, by team to the railroad or to the place where it was to be used.

The writer's earliest recollection was of hearing his grandfather tell how he burned and sold a kiln of lime to pay the expenses of his wedding trip of eighty miles to Boston, and return, in an oxcart.

The Rotary Kiln or Continuous Process

In this process the raw rock is fed slowly into the upper end of a nearly horizontal cylinder which revolves slowly and through which passes the heat from the furance at its lower end. The rock is heated and then calcined as it passes through the kiln and is discharged at the lower end in a continuous stream of burned lime.

The lime intended for sale as quick lime is barreled as soon as it is sufficiently cooled; that to be sold as bulk lime is conveyed to storage bins; and that intended for hydration is at once crushed to about the size of a pea and elevated to the storage bins from which it is fed to the hydrators as needed.

Hydration

In one type of hydrator the crushed lime is fed into the top of one of six cylinders placed horizontally one above the other, it being at the same time sprayed with about 23 per cent of its own bulk of water. These cylinders are each provided with paddles which mix and convey the lime and water from one to the other,

the water in the meantime being absorbed and the lime being practically dry when it is discharged from the lower cylinder.

It is then elevated, passed through a screen and an air separator from whence the fines go to the hydrated lime storage bins, the coarse particles of unburned lime go to other bins from which they are drawn into cars for shipment to cement mills or fertilizer works.

The hydrated lime is drawn from the bins into Bates packers by which it is usually packed into sacks of either 50 or 100 pounds and then is stored ready for shipment.

Uses of Lime

Thousands of tons of crushed, unburned lime rock are shipped monthly to sugar refineries, paper mills, carbide manufactories, etc., where it is used in its raw state as in the foundries or paper mills or put through that process needed for use in that particular industry as burning and hydrating, in the sugar mills where they usually have their own machinery for this purpose.

Much more is used directly in the portland cement manufacture which requires about 450 pounds of limerock for each barrel of cement made and is probably the largest line of users. Large quantities of limerock are used in road and bridge building, and in other heavy concrete work as aggregate and for fills and surfacing. A considerable quantity is also finely ground and used for a "sweetener" for some kinds of soil, and other less finely ground is sold as grits for poultry feeding.

A large quantity of limestone is used for building stone and coping and was formerly used as flagging for sidewalks. This last has largely been superceeded by the use of concrete.

Rock for these purposes is got out in large blocks from the quarries, which are sawed, chipped, or turned to their desired shapes by very heavy machinery.

The barreled, bulk or hydrated lime shipped from the lime plants is largely used in the building trades, in which the use of lime slaked and made into mortar, and used for rock or brick laying, plastering, etc., was very general long before cement came into common use.

The use of hydrated lime and quick lime in the United States alone amounts to millions of tons per year. Large quantities of lime are also used in sewage disposal and water sweetening operations. Considerable lime is also used in the manufacture of chemicals, bleaching preparations, soaps, paints and many other purposes which cannot be mentioned at this time.

In summing up the total uses to which lime is put in its various forms, we find it to be more widely distributed and quarried and to be used in greater quantities than any other rock.

Lively Lime Products Company Planning Expansion

Construction work will soon start on an inclined gravity tram to handle the commercial lime rock from the quarry of the Lively Lime Products Company to the trucks which will transport it a distance of three miles to the Gold Hill station on the Southern Pacific Railroad. The method used at the present time is not very efficient in that the lime rock is broken somewhat in handling from the quarry to the trucks. As this lime rock is used for the manufacture of paper, it is very desirable that the percentage of small particles be kept at a minimum.

A 6 ton kiln for the production of quicklime has been installed. Open pit mining is used, and the layout is arranged so that there is no lifting of material. A good market is developing for the lime and the raw lime rock for use in other manufacturing processes.

The company has been organized eleven months. The officers are: M. S. Johnson, President; J. M. Lively, Vice President and Treasurer; and J. W. Lively, Secretary and General Manager. The plant and the office are at Gold Hill, where all of the officers reside.

Barber-Greene Announce

Mr. B. E. Lindstrom is now in charge of the Chicago office of the Barber-Greene Company. Mr. George R. Bascom, who died on June 26th, 1925, was formerly in charge. Mr. Lindstrom has been associated with Mr. Bascom for the past five years and has been a member of the Barber-Green organization since 1918. Mr. Harold R. Haase, who has been a member of the Chicago organization since 1920, is associated with Mr. Lindstrom.

Building the Largest and Most Modern Lime Plant on the Pacific Coast

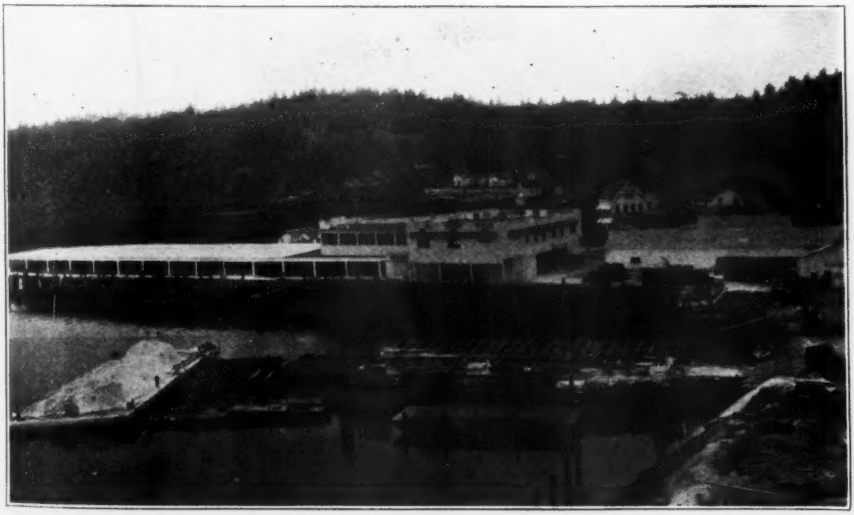
By E. D. Roberts

CONSTRUCTION is now under way on the last unit of the reconstructed plant of the Roche Harbor Lime and Cement Company, at Roche Harbor, Washington. A disastrous fire in the summer of 1923 wiped out all of the modern part of the plant as it then existed. The spirit of the company is shown by the fact that within six days after the fire two kilns were placed in operation. Work on reconstruction had actually commenced before the fire was extinguished. Plans have been made to add several units to the present plant which will make it the most modern and also the largest plant of its kind on the Pacific Coast and one of the largest in the world.

The production of lime at Roche Harbor is very intimately associated with the early history of the United States. It was here that the British troops made the first lime burnt in a kiln on the Pacific Coast, while these troops were stationed at Roche Harbor as a guard during the dispute over the international boundary. As you probably know, this dispute was settled in favor of the United States by arbitration. The old kiln built by the British troops is still standing. This means a lapse of 65 years as it was built in 1860. A forge which was built at the same time is also still standing.

Commercial production of lime at Roche Harbor was started by Scurr Brothers in 1880, and operations were conducted under the name of R. Scurr and Company. This company built two stone kilns with wooden cribs on top. The lime rock was quarried above grade and dumped into the bins from above.

A consolidation of the Tacoma Lime Company and the R. Scurr and Company was effected in 1886, and the new company incorporated under the name of the Tacoma Roche Harbor and Lime Company. Mr. John McMillin, who had been operating the plant of the Tacoma Lime Company at a location now known as McMillin, assumed charge of the new organization as its president and immediately started to enlarge the Roche Harbor plant. Three new steel kilns were added. Later a battery of four kilns was added. A later addition of four more kilns with the two original kilns brought the plant to thirteen kilns. During this period Mr. McMillin also developed the other property of the company, and today the Roche Harbor Lime and Cement Company has



View of Dock and Store With Foundations for New Buildings in Foreground

seven different quarries all containing excellent stone. These developments and improvements were all paid for out of earnings. Mr. McMillin, who is generally known as "Commodore," is today one of the most widely known men in the Northwest. Every year Mr. McMillin holds a Harvest Festival at Roche Harbor for the employees and friends of the company. This year it was held during the first week of August and was the most successful and brilliant of anything of its kind on the Pacific Coast. The company entertained guests from all over the world.

When the United States entered the World War, orders were issued to close the plant of the Tacoma Roche Harbor Lime and Cement Company as it was termed a non-essential plant. The company soon demonstrated that more than 160 basic industries so designated by the government were with the exception of 20, dependent upon lime in some form for existence. They were then not only permitted to operate but were forced to do so under certain conditions. The most serious of these conditions was that they could not ship past Port Angeles. This order cut off the trade from California and the Hawaiian Islands. This business amounted to 160,000 barrels annually. The British operators were not barred from this same territory, and they utilized this advantage, even shipping past the Roche Harbor Lime and Cement Company's plant. The British lime, however, did not satisfactorily meet the requirements for lime in the manufacture of sugar, so kilns were installed in the Hawaiian Islands to burn coral which evidently did meet the requirements. The restriction placed during the war was removed at the signing of peace, but the British had established connections in California and the Hawaiian Islands which still exist. The operators of the coral kilns have developed a business which they have no intention of abandoning. These facts have no doubt restrained the Roche Harbor Lime and Cement Company in many proposed plans for expansion.

The strata of the quarry deposit shows a layer of limestone about 200 feet thick lying between two layers of shale. In a few places glacial drift lies on top of the shale or lime rock and this is removed hydraulically. The shale that lies over the lime rock is removed and placed in sorted piles. The small particles of lime rock that can not be sold are dumped in piles. At present there are several million tons of this lime rock broken in small particles waiting to be reclaimed for making cement. Chemical analysis shows that this shale is excellent for making cement. They have also developed a large clay deposit about a mile from the mill site that they propose to wash and pump to the mill. Preliminary plans have been prepared for a 5,000 barrel cement plant to utilize the small lime rock thereby

Battery of Eight Kilns Showing Stone Storage

reducing the cost of lime manufacture and making it possible to produce cement at a low cost on deep water.

At present, the lime rock is hand picked and loaded onto 1½ yard cars, manufactured by the Pacific Car and Foundry Company, that run by gravity to the bins over the kilns or to the bins that chute it onto barges when sold as raw rock. Rock for the kilns is drawn from the bins by a hand gate and passes over an inclined grizzly that allows the fines that were made in dumping to fall through into a chute. These chutes are arranged in pairs so that a car spotted between two kilns on the lower level will receive the fines from them. These fines are screened for chicken grits and the refuse used in keeping up the plant and farm roads.

Fir wood which is used for burning the lime rock is cut on the property or contracted for from the farmers and loaded on company barges. After burning, the lime rock falls down into the lower part of the kiln which takes the place of a cooler and is later drawn off into an inclined chute in which it is broken to the proper size for barrelling and raked down into the barrel.

The barrel is weighed accurately and then placed in a machine to hold the staves in place while the top rings are removed for the placing of the head. This machine is a cable arranged to form a loop in which the barrel is placed. The cable is drawn tight by means of turning a wheel that causes a bar to turn, the ends of which are threaded in the opposite hand, causing threaded blocks of metal holding the ends of the cable to travel from each other. The heads are laid out in a pile and a complete head picked up by means of a specially made picker having nails protruding from one side. These nails are driven into the head boards by tapping the top of the picker. A complete head is picked up in this way and held in the proper position while the top ring is replaced after which the cable is loosened. Driving on of the wire ring, stapling and nailing of the head with six penny nails completes the packing. It is then stenciled with the company's brand, "Roche Harbor Lime & Cement Co," arranged in a circle around their emblem which is a six pointed star. The name of the burner, date and kiln number are also stenciled on the barrel to facilitate tracing and identification in case of complaints.

Two horse drawn flat cars holding 24 barrels each then transport the lime over a narrow gauge railroad to the storage warehouse, holding 15,000 barrels. An auxiliary warehouse has a capacity of 5,000 barrels, making the present storage capacity 20,000 barrels which will be increased as soon as the packing building is completed, construction of which is now

One of the Quarries

under way opposite the battery of eight kilns. The building will be three stories high with the top story for storage of barrel parts, a cooperage on the second and lime storage on the dock level.

A conveyor is to be constructed to elevate the wood from the barges to another conveyor operating along the furnace doors from which it will be tripped at the desired point by a movable tripper.

Hydrated lime will soon be marketed by this plant. The plans call for a conveyor along the front of the kilns at the drawing floor level. The burnt lime will be raked over a grizzly constructed over the conveyor causing the smaller particles of burnt lime to fall on the belt and to be carried to the hydrator.

Montana fire bricks are used to line the kilns. Special bricks are formed to make the grates, eliminating cast iron grates.

Compressed air for operation of the quarry drills is furnished by an Ingersoll-Rand air compressor. The power for this compressor is furnished by a 60 horse power boiler operating an Atlas steam engine. This engine also is used as a stand-by to operate the electric generator which furnishes electricity for lighting throughout the plant and for domestic use. Regularly a gasoline engine drives an Allis-Chalmers generator to make this electricity.

A machine shop and blacksmith shop make the plant independent of outside repair shops. The old cooperage is in use at present and will be until the new building is completed. The barrels are put together by unit operations much the same as is practiced in automobile manufacture. The barrel passes from one man to another, and each does his particular part.

The company owns 4,000 acres, more than 160 acres of which are in cultivation in unit farms. The best is Belleview which took its name from that given to the island by the early French. These farms raise all the green vegetables, butter, eggs, meat, etc., required for the employees and to run the Hotel De Haro which is operated by the company. A large company store supplies the wants of employees with families who are living in the company village.

Encouragement is given to social functions by means of a well equipped moving picture theater and stage, a commodious kitchen with dishes, etc., and a large reading room overlooking the harbor in which comfortable chairs, current magazines and a pool table are found. Interest in the use of them has been stimulated by the formation of the employees into the Roche Harbor Yacht Club.

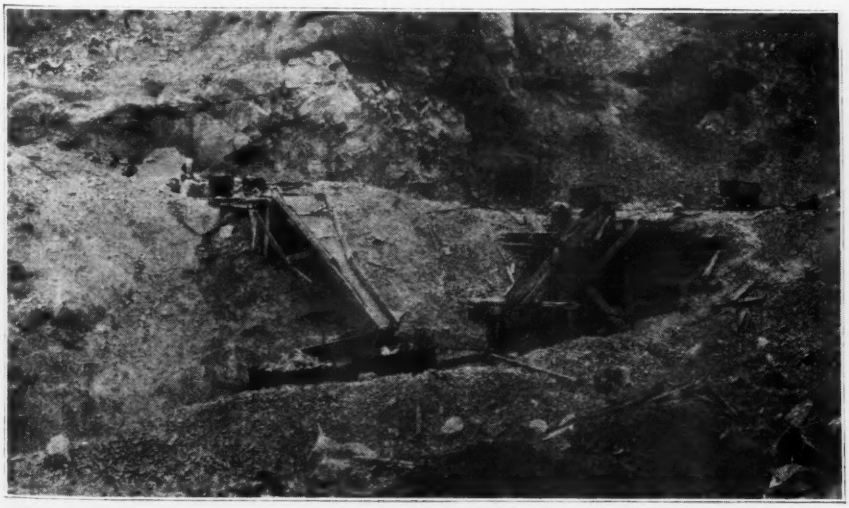
Another interesting feature of this plant is the Harvest Festival given every summer by the Company. This

Fordson Handling Rock to Kilns

Kilns With Trestle Approach and Firing Floor Temporarily Covered With Canvas

was started years ago when they observed an annual picnic day. This was changed later to a three day event at which time the employees and others are guests of the company. This has grown until this year there were over 200 outside guests from all parts of the country and our possessions. These guests are representatives of the press, labor unions that come in contact with lime such as plasterers, hod carriers, etc., agents, salesmen, architects and transportation agents.

Two large fireplaces have been constructed, one in the end of a large rectangle over which a tent is placed to house the men who give up the hotel to the ladies, the other is in the end of a similar rectangle where the dinners, speechmaking and entertainments are held. These fireplaces are equipped with large broilers 3 feet square and supported by a roller run-



Another of the Quarries

ning on an overhead track. Whole salmon weighing 40 pounds each are broiled in them.

A new private office for Mr. McMillin has just been completed. The outside is lime stucco spotted with color making a very pretty effect. The inside is paneled, each panel being finished in a different plaster finish, making a very good exhibit of the many effects that can be had by the use of lime for finishing work.

There are 16 kilns now being operated on the San Juan Islands at less than 40 per cent capacity. The Orcas Lime Company has one kiln about a mile from Roche Harbor, and the San Juan Lime Company has 2 more kilns. Only 4 of the 13 kilns are able to operate at Roche Harbor. In addition to the above there are 6 abandoned kilns on Orcas Island with the prospect of another company coming into production. It would seem that these operators, who had part of their market given to foreigners during the war, should be favored with a tariff that would shut out this dumping of lime on our markets, and made by a class of men that would cause the boycott of any company pursuing the same practice in this country.

Cast Steel Conveyor Chain

"Farrel's 85—Special Purpose Cast Steel" is now being used to manufacture chains for elevators, for conveyors and for power transmission. This new cast steel is especially well adapted for use in conveyor chains. It has shown high tensile strength and great resistance to wear and abrasion in numerous tests. This means that chains made from it can be used for heavy conveyors and for conveyors handling abrasive materials without breaking down and causing trouble.

Chains of "Farrell's 85" incorporate the high qualities of those made from the more expensive alloy and manganese steels, and the cost is materially lower. Stephens Adamson Manufacturing Company of Aurora, Illinois, manufacturers of conveying and elevating machinery, have the sole rights for chains made from this special purpose steel. They are putting it out in several types of chains; combination, ley-bushed, heald type, and 1130 class roller chains, with the necessary attachments for carrying elevator buckets and conveyor flights.

Freight Car Loadings

More cars were loaded with revenue freight during the week ended August 29 than ever before for any one week on record, according to reports filed by the railroads with the car service division of the American Railway Association. The total for the week was 1,124,436 cars.

This exceeded by 12,091 cars, the previous high record for any one week made during the week of October 24, 1924, when 1,112,345 cars were loaded.

This also was the third time on record that loadings have been in excess of 1,100,000 cars for any week, the other two times having been in October, last year.

Ore loading totaled 63,075 cars, an increase of 2,620 cars above the preceding week and 14,152 cars above last year but it was a decrease of 15,118 cars under the same period two years ago.

A comparison by weeks follows:

	1925	1924	1923
Aug. 29	1,124,436	1,020,809	1,092,150
Aug. 22	1,080,107	982,700	1,069,915
Aug. 15	1,064,793	1,019,077	1,062,993
Aug. 8	1,051,611	941,407	978,750
Aug. 1	1,043,063	945,613	1,033,466
July 25	1,029,603	926,309	1,041,415
July 18	1,010,970	990,230	1,001,350
July 11	982,809	909,973	1,019,800
July 4	864,452	757,904	850,082
June 27	901,341	908,251	1,021,471
June 20	982,600	803,546	1,005,432
June 13	987,106	902,592	1,008,838
June 6	994,874	910,793	1,012,312
May 30	920,514	986,209	820,551
May 23	986,209	918,214	1,015,532
May 16	984,916	913,201	992,319
May 9	981,370	908,213	984,078
May 2	981,711	913,550	961,617
April 25	959,225	878,387	962,578
April 18	922,778	876,916	970,042
April 11	917,284	880,937	945,271
April 4	922,375	961,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
Feb. 28	862,910	944,544	916,624
Feb. 21	925,295	945,679	830,187
Feb. 14	902,877	935,589	816,646
Feb. 7	928,244	906,017	849,352
Jan. 31	896,055	929,623	865,314
Jan. 24	924,254	894,481	396,464
Jan. 17	932,150	894,851	864,297
Jan. 10	932,807	872,023	873,908
Jan. 3	765,727	706,292	727,246

Producing Sand and Gravel Economically And With Gold As A By Product

By E. D. Roberts

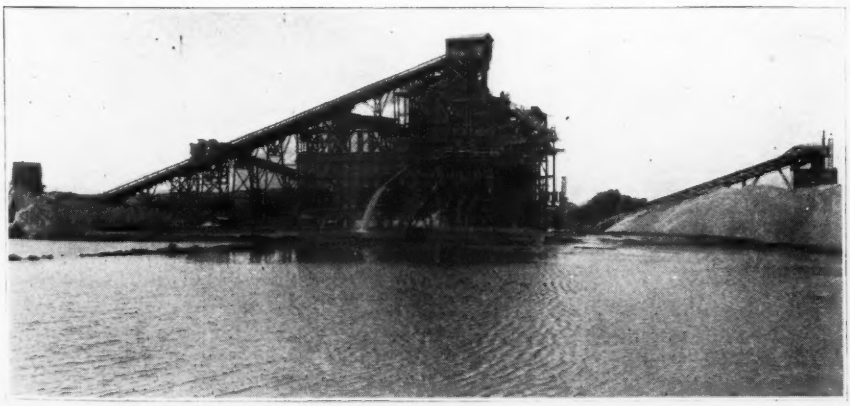
DIGGING, screening, crushing, sorting and washing over 2000 tons of sand and gravel per 8 hour shift as a regular thing has demonstrated that the new plant of the Service Rock Company near Fresno, California, is operating very efficiently. The pit and plant are located on a spur of the Southern Pacific Railroad about 16 miles from Fresno on the San Joaqin River, and on the main highway to Friant, a small town about 3 miles up the river from the plant.

Systematic sinking of test pits shows that the gravel is overlaid with an average overburden of 3 feet of silt and that the underlying gravel is from 30 to 90 feet in depth over the 600 acres owned by the company. No attention is paid to this overburden which is excavated along with the gravel and washed out later. This saves considerably in labor and increases the digging efficiency.

A Bucyrus dragline outfit with a 100 foot boom operates a 5 yard bucket which digs the gravel and dumps it into the dump cars. These 20 yard Western steel dump cars are hauled to the receiving pit by a 27 ton Porter locomotive. Air, controlled from the engine, causes the cars to dump their contents upon a grizzly placed over the top of the reinforced concrete hopper. Occasionally a large boulder is retained upon the grizzly which is raked off to one side by hand.

Two reciprocating Bodinson feeders feed the material at a regular rate to a 36 inch belt conveyor. In case the material should not run freely, a water tap with hose has been provided to wet down the sides of the hopper, thereby causing the gravel and sand to flow. The 36 inch belt which carries the gravel to the top of the bunkers operates upon 365 foot centers. A large stream of water plays down into the gravel as it falls from the belt at the head pulley which causes the sand and silt to leave the gravel in the first section of the 60 inch by 20 foot revolving screen installed just under the head pulley. This screen segregates the gravel into three sizes: namely; 2 to 3 inch; 3 to 5 inch; and rejects, each kind falling into a separate bin.

The stream of sand and small gravel is divided each stream going through a set of three conical screens in line which sort out in order the 1½ inch maximum, the ⅝ inch maximum, and the $\frac{5}{16}$ inch maximum, allowing the sand to pass on. A stream of



Side Elevation of the 2,000-Ton Service Rock Plant Showing Settling Pond in Foreground

water is sprayed into each screen while in operation.

Originally the sand was turned to the south over a gold recovery table and then over a Door classifier and a Bodinson Classifier which sorted the sands and dropped them into a bin underneath the classifier while the dirty water passed down an inclined flume into a settling pond. The amount of small sized sand thus obtained was much greater than the demand, so another gold recovery table was placed on the north side of the bunkers and the stream turned this way in case the sand was not required. The water and sand pass down an inclined flume, and after leaving the flume the sand is deposited and the water runs off. About $100.00 in gold is recovered during normal operation of the plant for 12 hours.

Along the north side of the bunker a battery of crushers is so placed as to draw the gravel directly from a bin to the crusher serving it. A 24 inch inclined belt operates under the crushers which carries the crushed rock to the west until lit reaches the 36 inch belt from the receiving pit, where it is dumped onto another 24 inch belt operating parallel to the 36 inch belt. This 24 inch belt discharges the crushed rock into a 48 inch by 24 foot revolving screen which segregates it into dust to ⅛ inch; ⅛ to ½ inch ½ to ¾ inch; ¾ to 2 inch; and rejects. The finest material passes through another revolving screen which takes out the dust. All the different sizes fall into their respective bins below.

The battery of crushers, referred to above, is composed of a 24 inch Simon crusher operated by two 15 H.P. motors which crush the 2 inch to 3 inch rock; a Farrel jaw crusher operated by a 50 H.P. motor handling the rejects from the 60 inch screen; a number 6 McCulley crusher breaking up the 3 inch to 5 inch rock with a 50 H.P. motor; and another Simons crusher operated by a 40 H.P. and a 30 H.P. motor. A new departure in the operation of Simons crushers has been tried here with great success; that is driving a crusher with two

The 36-Inch Conveyor From Track Hopper and 24-Inch Conveyor From Crushers

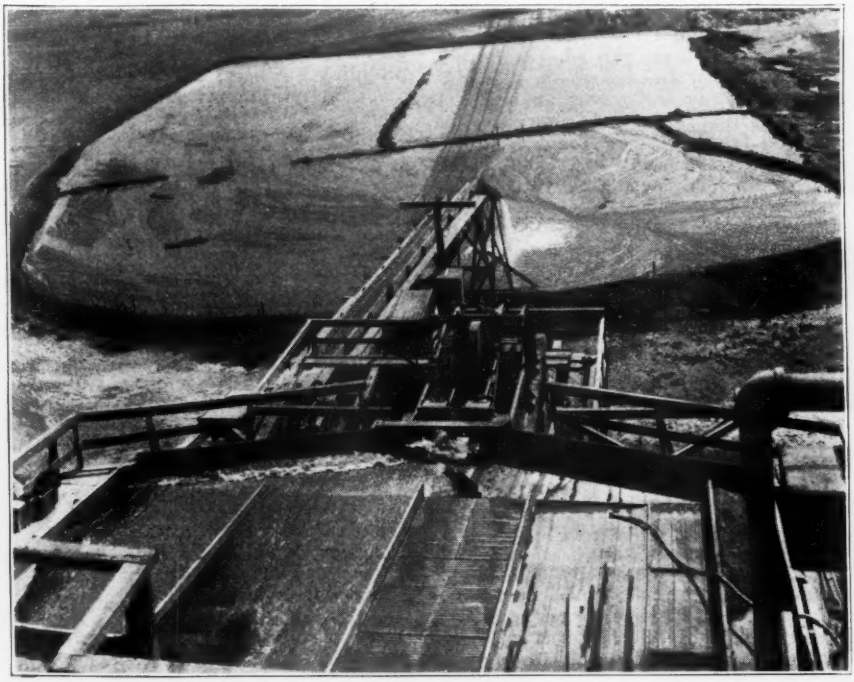
General View of Service Rock Plant

independent motors instead of with one motor using a jackshaft as heretofore.

The sides of the bins are of wood resting on a floor of reinforced concrete supported by longitudinal walls forming a tunnel under the length of the bins. Gates have been placed in the top of this tunnel leading the gravel onto a 30 inch belt which carries it along under the bins and then up an incline to discharge the material into a loading bin. By this arrangement any desired proportions of the various sizes may be mixed.

The loading bin has a gate which discharges into a car spotted along side on the track or into a truck. In case a full shipment of any size is desired, gates may be opened in the side of the bin and the gravel spouted directly into cars for shipment.

If the main bins are being filled faster than shipments are going out at the time, a Plymouth gasoline locomotive spots a flat car fitted with tem-



The Gold Saving Riffles and Settling Pond. These Riffles Catch the Gold That Is Carried Through the Sand

porary sides under the spouts on the south side of the bins and moves the car along as it is filled. The Plymouth then hauls the loaded car out to a Brownhoist yard crane which unloads the gravel with a 1½ clamshell onto the stock pile. Later when the demand becomes greater than the plant can supply, the crane will reclaim it and load the cars for shipment directly from the stock pile. The Plymouth also spots cars for shipment when full cars of one kind of rock is desired thus saving handling over the shipping belt to the shipping bin.

A Fairbanks Morse centrifugal pump throwing 2100 gallons per minute furnishes the water for washing the sand while a DeLavel pump, with a 20 H.P. motor capable of throwing 1500 gallons per minute, has been installed as a "standly." Fairbanks Morse ball bearing motors are used throughout the plant, while the Bodinson Manufacturing Company designed and furnished the screening and conveying machinery. The R. H. Felchin Company, engineers and architects of Fresno, drew the plans and constructed the plant for the Service Rock Company. Mr. A. H. Sienknecht is operating the plant in the capacity of superintendent. He reports just completing a long run on one order which received 25 cars of one class of material a day for several months.

Electricity for motor operation is received from the San Joaquin Light and Power Company at 11,000 volts and stepped down to 440 volts. The plant requires 350 horse power to operate continuously. The conveyor and transmission belting is of New York Belting and Packing Company manufacture.

The officers of the Service Rock Company are: J. D. Patterson, President; Sig Wormser, Vice President; and H. B. Nelson, Secretary-Treasurer. Directors of the company are Messrs. Patterson, Wormser, Nelson, A. Bernhauer, and H. W. Jones. Offices are maintained at 428 T. W. Patterson Building, Fresno, California.

Linde Change

L. M. Zimmer has been appointed General Sales Manager of The Linde Air Products Company, manufacturers of oxygen, and of the welding gas division of The Prest-O-Lite Company, Inc., manufacturers of dissolved acetylene, succeeding L. M. Moyer, who resigned August 1st, 1925.

New Locomotive Booklet

A wide variety of quarry hauling operations, as well as hauls from sand and gravel pits, is shown by photos in the new bulletin just published by Heisler Locomotive Works of Erie, Pennsylvania. The bulletin presents figures on cases where the hauling capacity in a quarry has been increased from 60 to 100 per cent, hauling over rough temporary track with steep grades, and around sharp curves. This is the class of work for which Heisler locomotives are particularly well suited.

The booklet is conveniently divided into sections according to the different industries served. One section, on quarry hauling, shows how operators have been able to meet rush orders during their "oversold periods" without increasing the locomotive tonnage and without running a night shift. Another section gives cases of increased hauling capacity in sand and gravel operations. A third section tells about one operator who was able to open up a mine by the strip pit method after his engineers had declared that underground mining would be necessary, on account of the high cost of hauling up the steep grades made necessary by the strip pit mine. A Heisler locomotive made open pit mining practicable and economical in this case, at a considerable saving.

The booklet contains some interesting comparative records of different methods of haulage used on both large and small operations, data which will prove of value to any operator. There are records from such well known concerns as Bessemer Limestone & Cement Company, Solvay Process Company, Crow Creek Gravel Company, Lock Haven Fire Brick Company, Queen's Run Refractories Company, Snow Storm Silver Lead Company, Lukens Steel Company, McKena Chemical Company, etc.

Kuhlman Electric Appoints

The Kuhlman Electric Company of Bay City, Michigan announces the appointment of the D. H. Braymer Equipment Company, 727 W. O. W. Building, Omaha, Nebraska, as district representatives in Iowa and Nebraska. The D. H. Braymer Equipment Company will handle Kuhlman Power, Distribution and Street Lighting Transformers.

Stone That You Can Mould

By Chester N. Reitze

Part I.

This paper was presented before the Seattle Mining Club, on August 5, 1925, at Seattle, Washington. While the information contained here is known to our readers it will be a pleasure to read such a graphic presentation of the subject. Mr. Reitze is assistant general manager of the Portland Cement Association at Seattle. The second and last part will appear in the October 1st number of Pit and Quarry.

Editor.

SHOULD you ask the average person what he knows of concrete, no doubt he will point to the concrete building that is being erected on the opposite corner, the concrete road over which he drove to work that morning, the concrete sidewalk that he has just laid in front of his new concrete house. If your casual informer happens to be an engineer, he may mention innumerable construction projects; hydro-electric developments, drainage systems, railroad bridges, irrigation dams, even barges and ships. If he is a farmer, he reminds you of the concrete barn that he is just completing, the concrete silo that has so materially enhanced the value of his farm, a hundred and one uses that you, the city dweller, might never think of. Yet even by continued questioning it is doubtful whether you would more than broach the list of uses of this ingenious and mysterious, yet simple combination of elements—concrete.

But step back thirty years. There were few concrete pavements; reinforced concrete buildings had been conceived, but few built; stone masonry featured the hydraulic and railway developments. The small amount of concrete laid during those years was used mostly in concrete sidewalks, foundations and simple concrete structures.

But every year since then has seen new uses developed and old uses expanded until in the United States last year some 100,000,000 cubic yards of concrete found a host of applications varying from a small garden vase to the largest hydro-electric development ever attempted—the Wilson Dam of Muscle Shoals with its 1,260,000 cubic yards of concrete masonry.

Visualize that total of 100,000,000 cubic yards if you can. In more familiar terms it may be pictured as sufficient concrete to build a national highway from the Atlantic to the Pacific. This highway would be 280 feet wide—wide enough for 34 cars at one time. Or if fashioned into houses of six rooms each, concrete from the cellar to the roof with a concrete porch and sidewalk thrown in, there would be 1,500,000 individual homes—enough for every family in New York City.

And after compiling your list of applications, ask the same average person what he knows about concrete construction, the materials involved, and something of its history. To this inquiry the response is apt to be meager. Many, however, will be able to tell you that cement is an ingredient, and in this they are quite right. To make possible the concrete construction of last year, there were produced approximately 150,000,000 barrels or 600,000,000 sacks of portland cement in this country alone. The marvelous improvements in the manufacture of this material have made cement available for universal use and, consequently, given concrete a place in remoulding human environment.

Long before the Roman Empire was established, the Carthaginians built and aqueduct some 70 miles long in northern Africa, using a natural cement. A similar cement, made from slaked lime and volcanic ash, was employed in considerable quantities by the Romans. In the ruins unearthed in northern Italy, examples of construction using this natural cement showed a high proficiency in the art. Remains of a great national highway system reaching into northern France have been found and in Italy sections of those roads are in use today. Perhaps the Pantheon at Rome, built by Hadrian about 120 B. C., is the finest example of the early use of cement in building construction. The dome of this ancient structure is 142 feet in diameter, five feet more than the famous dome of the National Capitol in Washington.

As society degenerated and finally sank into the depths of the Dark Ages, the art of cement making van-

ished along with so many other accomplishments. Some 170 years ago a contract was awarded to John Smeaton, an eminent engineer of that period, to construct a light house on the northern shore of the English Channel. Unwilling to trust the mortars of his time to the battering of the channel gales, he began in 1756 a long series of experiments to find a material that would harden under water. Three years later he brought to completion the lighthouse that stood for a number of years as a warning to the mariner, symbolic of a revived era in building construction. In casting around for the right material, Smeaton discovered that an impure limestone with clayey content made a desirable cement after it had been burned and ground and that it would harden under water—a distinct advantage over the mortars then in general use.

In the various natural cements that followed, the proportions of the ingredients depended upon their combination as found in nature. There was no way to vary the quantities of the various elements. In 1824, one hundred and one years ago, Joseph Aspdin, a brick layer in the old English town of Leeds, terminated a series of experiments by securing a patent on a material that he designated as portland cement. In making this artificial stone, he hit upon the idea of taking a portion of limestone and mixing with it a predetermined amount of clay. This he burned and then ground to a fine powder. By this method he was able to produce a cement far superior to any then on the market. So much did the hardened product resemble the building stone quarried on the isle of Portland that he described his cement as "portland."

Forty-five years ago, the output of the American plants totalled some 40,000 barrels—just enough for twelve miles of concrete roads. Fifteen years later, production had jumped to a million barrels a year, and the industry turned toward a quarter century of rapid expansion. Soon after Saylor had started his first plant at Coplay, Pennsylvania, in 1872, a deposit of favorable raw materials was discovered near San Antonio, Texas. A company was organized in 1880, capitalized at $3,100 to begin the manufacture of portland cement in that state. The venture prospered and commercial expansion later forced that company to abandon the original quarries.

Today there are over 90 companies operating some 137 plants located in 36 different states. Yet is you ask for a bag of portland cement in Maine or California, Wisconsin or Texas, you will get a material that has been made to meet the certain, definite, strict standards adopted by the government and the engineering societies. The raw materials from which the product was made may, and probably do, vary greatly; yet the finished product is of the same elements and, essentially in the same proportions.

Raw Materials

To manufacture a barrel of portland cement requires more than six hundred pounds of raw materials and some two hundred pounds of coal or equivalent fuel. During the burning of the powdered raw mixture in the kilns, more than a third of its weight is driven off as carbon dioxide. The resulting barrel of cement weighs 376 pounds, and has a volume of four cubic feet,—a cubic foot to the sack.

The modern cement plant is a small-sized community in itself. Unlike most industries, the cement plant often cannot enjoy the advantages of the established industrial center. Frequently, deposits of raw material require its establishment miles from the nearest city. Great piles of coal or huge tanks for oil, small mountains of raw material and clinker, mammoth storage bins for the finished product, great buildings housing the extensive machinery, possibly homes for the workmen may all be seen at many plants.

Fundamentally, the raw material of portland cement is a properly proportioned mixture of calcareous and argillaceous substances. In familiar terms, it is a combination of lime and clayey materials with lime in the majority. Now these materials may be obtained from a number of sources. While most of the plants in this country depend for their supply of lime upon certain varieties of limestone, occasionally it has a curious source. Soft, granular chalk or wet, sloppy marl may be used. The clayey materials usually come from clay or slates and shales. Down in Texas and California there are plants that find oyster shells in sufficient quantity to provide all the necessary lime. One of the largest plants in the world daily consumes sixty carloads of blast furnace slag, a by-product from a neighboring industry, to supply part of its lime and the clayey ingredients.

Quite naturally, a visit to the cement plant begins in the quarry. In the selection of a site for a portland cement plant, the costly machinery must be secured by guarantee of an unfailing supply of raw materials for years to come. Great bowls in the earth, resembling the Culebra Cut of the Panama Canal, criss-crossed by a network of industrial railroads or a web of aerial hoists, have grown bigger and bigger as the demand for the raw materials has taken its daily toll. Thirty years ago the 700 tons of rock used per day by the entire industry was quarried in a small, retail way. Today the average plant requires much more material every working day than did the entire industry at that time. In supplying the raw materials for cement last year over 17,000,000 pounds of explosives were consumed, If the visit has been well timed, a close inspection of the quarry will be delayed for the shot that is about to take place. As much as 400,000 tons of hard limestone, a virtual mountain, has been disemboweled from the secure deposits of the earth by a single plunge of the quarryman's timer.

Once the rock has been loosened and the pieces too large to handle have been shot to smaller sizes, giant steam shovels load the stone into long trains of gondolas, or perhaps into aerial hoists, and it is conveyed to the plant where its conversion into portland cement begins. The crusher house is the first chapter of an interesting story of industrial accomplishments, another step in the journey from mountain to powder.

Hardinge Exhibits

The Hardinge Company of York, Pennsylvania, will occupy booth number 60 during the Chemical Equipment Exposition in New York, September 28th to October 3rd. Mr. J. S. Halbert will be in charge and will be assisted by Messrs. Withington, Metz, Towers, Bamman and Cunningham. Working models of the Hardinge Conical Mill with the new reversed current air classifier, the Hardinge Super Thickener, the Hardinge Rotor Spray and the Ruggles Coles Dryer will be exhibited. The super thickener and spray are just being introduced to the trade. Bulletins describing these machines in detail are now on the press and will be ready for distribution in time for the exposition.

International Promotions

The International Cement Corporation announces that H. C. Koch has been appointed Vice President in charge of sales and publicity for the domestic and foreign properties of the International System. It is also announced that upon the completion of the Norfolk plant of the Virginia Portland Cement Corporation, Ejnar Posselt will assume the duties of Vice President in charge of operation and construction.

Mr. Koch has been General Sales Manager of International for several years, prior to which time he was in charge of the sales of the Texas Portland Cement Company. Before the formation of the International System Mr. Koch had gained a broad experience on cement merchandising throughout the country.

Prior to taking charge of construction operations at Norfolk Mr. Posselt was Vice President in charge of foreign subsidiaries in the International System. He is well known to the industry, having served in various technical capacities in this country for many years.

These appointments and assignments are in recognition of meritorious services which these men have given to the International System and are in keeping with the expansion of that growing organization which recently acquired the Indiana and Alabama Portland Cement properties.

Hyman Michaels Purchases Entire Railroad

Another tremendous deal involving the purchase of the entire physical assets and property of a railroad was recently announced by the Hyman-Michaels Company of Chicago. The Kalamazoo, Lake Shore and Chicago Railway, being unable to compete successfully with motor transportation now operating parallel to its right of way, recently sought and was granted permission by the Interstate Commerce Commission to discontinue service and abandon its line.

As soon as the equipment was offered for sale, numerous bids were received from dealers seeking different types of materials. The Hyman-Michaels Company, however, offered to take over the entire physical assets, and the deal was quickly consummated. The purchasers have determined upon the immediate disposal of the entire equipment.

Analyzing Freight Rate Problems In the Non-Metallic Industries

Written Expressly For Pit and Quarry By L. E. Whitney

This is the fourth of a series of articles by Mr. Whitney, who is a member of the firm of Gorman and Whitney, traffic advisers, who are conducting a special investigation for Pit and Quarry in certain freight rate matters as they pertain to conditions in the non-metallic industries.

Readers are urged to send to Pit and Quarry any freight rate problems, and Mr. Whitney will analyze the problem and make his recommendation. It may be that you want to know if your rates are in line. Any and all problems submitted will be dealt with expeditiously.

Editor.

MANY shippers believe that the matter of determining the proper freight rates to apply on their shipments is a very simple one, and that freight tariffs contain provisions that are readily understood by freight agents and accurately applied. Again, it is quite generally believed by individual shippers that they are fully acquainted with the applicable freight rates on their shipments, and that there is hardly any information that could be supplied them on such matters, which has not already been supplied by their local freight agent.

It must come as a matter of surprise to one believing along these lines, to find that very considerable overcharges have been assessed against his shipments by the railroads, and that refunds sometimes running into thousands of dollars can be secured on such shipments. It may be of interest to shippers in the non-metallic industries to know something about the many ways in which freight overcharges are erroneously assessed on shipments, and with this in mind the writer will endeavor to enumerate some of the instances which lead to such overcharges.

In the first place it should be borne in mind that there are literally thousands of freight tariffs carrying rates both on class and commodity basis. It is a practical impossibility for any local freight office to maintain a file of tariffs that is at all complete; and therefore, when ascertaining the proper rate to apply on a shipment, the freight agent is limited in his efforts to consideration of only the tariffs in his file. This can, of course, be supplemented by a wire to the general freight office of the railroad; but inasmuch as most freight agents think that it is easier and safer to collect all possible on shipments, and then to make refunds where too much has been collected, use of wires in such instances is seldom resorted to. Even though the general freight office were wired for rates, there is no guarantee that the clerk handling the matter would devote the study to it that would result in the lowest possible charge to the shipper. A station agent also has other duties to perform than the mere detail of making out freight bills on the cheapest possible basis to the shipper.

Many freight tariffs are sectional tariffs, and contain rates in these different sections that may be used alternatively on a particular shipment, and therefore a careful search of these different sections is necessary to arrive at the lowest possible basis for assessing charges. A simple illustration of this is instanced in Agent Boyd's tariff 50-L, in Section 1 of which a rate on sand and gravel from Galesburg, Illinois, to Oskaloosa, Iowa, is named at 11 cents per cwt. with a minimum weight of 90 per cent of the marked capacity of the car, except where the actual weight of a car loaded full is less than 90 per cent of the marked capacity, in which case the actual weight is to be used, subject to a minimum of 40,000 pounds. Turning to Boyd's territorial directory, it is found that Keithsburg, Illinois, takes Galesburg rates, and under such circumstances it would seem that the rate on sand and gravel from Keithsburg to Oskaloosa is 11 cents per cwt.; but, Section 2 of this tariff names a rate of 5½ cents per cwt. on sand and gravel from Keithsburg to Oskaloosa via the M. & St. L., and this is the correct rate to apply on such a shipment moving over this route.

Oftentimes a tariff will also contain

a scale of rates based on distances to be used alternatively with specific rates, and in such cases if the actual distance at this rate makes a less charge than the specific rate, such distance rate is to be used.

In a great many tariffs a provision is made for the application of the rates provided therein from or to intermediate stations and under such a provision rates are provided for or to stations as the case may be that are not specifically mentioned in the tariff. Freight agents seem to have a happy faculty of overlooking such provisions.

There occur many symbols and reference marks in tariffs that in one way or another have considerable effect on the application of the particular rate so referenced. Agent Boyd's tariff 41-N contains a large number of rates on sand, and some of these bear a circle 1 reference mark, with the notation at the bottom of the page to see page 12 for explanation of reference marks. One such rate so referenced is that of $3.40 per net ton to Akron, Ohio. Page 12 provides under the explanation of this reference mark that the rate on moulding sand will be $2.90 per net ton at a minimum weight of 60,000 pounds.

To cite a possible example of what may take place in an instance of this sort, we will suppose that a shipper made a 60,000 pound shipment of moulding sand to Akron in a 100,000 pound capacity car. The $3.40 rate carries a minimum weight provision of 90 per cent of marked capacity of the car, which would mean on this shipment, a freight charge of $153.00. However, under the provision of the reference mark the shipper would be entitled to pay charges on the basis of $87.00 for this shipment, or a difference of $66.00. This example may seem to be overdrawn, but in the writer's experience there have been many instances wherein differences under circumstances similar to the above have been discovered that amounted to several hundred dollars on a single shipment.

Where there are no through rates from point of origin to destination, rates are made on what is called a combination basis; that is, rates to and from some point to and from which rates are published are used. In such a case there is a tariff published which provides for a reduction on sand, gravel and stone of 30 cents per net ton from the through combination. It is not unusual for freight agents to neglect entirely the application of this combination rule in assessing charges.

The carriers find it necessary from time to time to issue supplements to tariffs to take care of some revision in rates or in some special provisions governing the application of the rates. Not infrequently freight agents seem to be completely oblivious to the fact that the effective supplements to a tariff are just as important in figuring a rate as the original tariff itself, and of course the shipper pays the difference, unless he is fully acquainted with the proper rates to be applied, or enjoys the services of an expert in such matters. One example of such an instance will serve to illustrate the point.

B. & O. tariff 3336-A provides a rate on sand and gravel from Columbus, Ohio to Black Lick, Ohio of 70 cents per net ton, and from Columbus to Heath, Newark and Union, Ohio, rates of 80 cents per net ton. In supplement 46 to this tariff the rate to Black Lick is reduced to 60 cents per net ton, and to Heath, Newark and Union to 70 cents per net ton. The title page of the supplement shows that these rates were effective September 3, 1925, but in the explanation of the reference marks immediately preceding the reduced rates it is recited that these rates became effective August 4, 1925. It is a fact that practically every freight tariff in existence contains changes in effective supplements, which make important changes in the rates.

Another source of freight overcharges is demurrage. The Interstate Commerce Commission has held that Item 6 of rule 4 of Agent Jones's tariff 4-E providing for written notice of arrival must be strictly complied with, and yet there are many instances in which freight agents have assessed demurrage charges after telephone or oral notice of arrival of cars, and consignees have paid such charges when the same are not legal. Questions involving computing time, free time, placement of cars, weather interference or bunching are sometimes extremely technical, and all demurrage bills should be carefully scrutinized to make sure that no recourse under the tariff has been overlooked.

Bills for switching services are sometimes erroneously presented by

the carriers where such charges are clearly to be absorbed under the tariffs, and this is particularly true in the larger terminals.

In view of the many opportunities that there are for errors to be made in freight bills, it is really remarkable that in a large majority of cases charges are collected on the correct basis. There is certainly no intention on the part of the carriers deliberately to overcharge a patron, and I believe that every reasonable effort is made by railroad freight office employees to render freight bills correctly. But, surely, there is a duty resting on the shipper to protect his interests in these matters, which can be done only by a comparison of the rates assessed with the rates legally applicable under the effective tariffs.

Standard Soapstone Completes Financial Organization

The Standard Soapstone Corporation has completed its organization under the laws of the State of New York, with a capitalization of $1,575,000, of which $1,000,000 is paid in. The company has taken over the entire assets and business of the Phoenix Stone Company, Inc., which was organized three years ago by W. Wallace Benjamin, in association with Charles O. Heydt and F. A. Benjamin, who have carried on and developed the business.

W. Wallace Benjamin and those at present associated with him in the management of the Phoenix Stone Company, Inc., will continue in charge of the operations and business of the Standard Soapstone Corporation, with the addition of Michael J. Copps, who has just resigned as a director of the Virginia Alberene Corporation to become Managing Director of the Standard Soapstone Corporation. Mr. Copps was formerly Vice-President and General Manager of the Virginia Alberene Corporation and has been actively engaged in the soapstone business for twenty-eight years.

A soapstone deposit of more than 1600 acres has been purchased in Nelson County, Virginia, including soapstone bearing lands purchased from Thomas Fortune Ryan, who has become a Director of the new corporation. The land owned, as indicated by extensive core-drilling, contains deposits of soft, medium and hard grade soapstone for commercial purposes in quantities sufficient to supply the entire United States at the present rate of consumption for 50 years. The company will engage in the quarrying, manufacture, sale and installation of soapstone products. The entire operation will be completed and the quarries will be producing before the end of the year.

The company by October 1st will have completed at a cost of $400,000 the erection of mills of steel and glass construction equipped with standard and special machinery for soapstone production. A 1000 horse power condensing steam turbo-electric generating plant is under construction on the Tye River. A six mile standard gauge railroad connecting with the main line of the Southern Railway is also being built. In addition to a number of houses completed during the last year, construction is under way of a new town site, including modern homes and stores for company employees.

It is estimated that the property of the Standard Soapstone Corporation in Virginia contains 25,000,000 cubic feet of soapstone. The plant and the quarries which are now being opened up are equipped with quarry machines, steam shovels, derricks, locomotives and rolling stock.

The officers and directors of the company are W. Wallace Benjamin, President and General Manager; Charles O. Heydt, Secretary-Treasurer; Clifton Reeves, Vice-President and Industrial Engineer; F. A. Benjamin; Thomas Fortune Ryan; Michael J. Copps, Managing Director, Mortimer J. Copps, Plant Manager; William R. Conklin and Alfred C. B. McNevin.

New James Catalog

The D. O. James Manufacturing Company of Chicago, manufacturers of gears, spur gear speed reducers, worm gear speed reducers, and couplings, announce their new general catalog, number 99, of 288 pages, which covers their complete line of products. It is fully illustrated and contains many pages of general engineering data which is of interest to engineers, designers and purchasers of transmission equipment.

This catalog is the result of much study and contains such information as is contsantly needed in designing and specifying drives of all kinds on elevating, conveying, power transmitting and process machinery.

Some Unusual California Plants

By H. W. Munday

OPERATIONS with many diversified problems and products can be found all along the Pacific Coast. In California are some of the largest and most spectacular of plants producing crushed stone and sand and gravel.

Graham Brothers Incorporated

This organization is one of the largest producers and distributors of crushed stone in Southern California. Their modern plant on Catalina Island is one of the most unusual plants on the Pacific Coast. In point of flexibility, simplicity, cost of operation and product, this plant is about all that could be desired. We have made a special study of the operations of this company which will appear as an article in one of the October numbers of Pit and Quarry, so we shall say little here. It is a remarkable side hill plant with a material handling system rarely seen in the entire industry. The engineering services in connection with this plant were rendered by Stephens Adamson Manufacturing Company who also furnished all of the transmission, screening, and conveying machinery. Quarry operations are carried on as a separate unit. This company operates plants at Catalina Island and Long Beach. The foregoing remarks had to do with the Catalina Island plant. In the Catalina Island quarry a Bucyrus shovel loads Western dump cars which are hauled by an American gasoline locomotive while in the Long Beach plant a Marion shovel loads Western dump cars which are hauled by a Plymouth gasoline locomotive. In the Catalina Island plant all material is moved either by gravity or belt conveyor. The quarry is operated practically as an independent unit as is also the mill and storage system. This is accomplished by a neat system of balance in capacity.

Consumers Rock and Gravel Company

This company is also a large producer of sand, gravel and crushed stone in the vicinity of Los Angeles whose operations will be the subject of a later article. They operate three plants with a combined daily capacity of 5000 tons which is largely distributed by their own fleet of trucks. Two of the three plants are dry screening and crushing plants, while the third operates a combined dry screening, crushing and washing plant.

The Hewitt plant of this company was originally designed as a dry plant, but the demand for washed materials resulted in another unit's being added shortly after it was placed in operation. The entire plant was designed by Stephens Adamson Company engineers. It has dual sources of both power and water and

Territory Surrounding the Graham Brothers Plant on Catalina Island. The Plant Can Be Seen in the Distance

is a protected plant operating at low cost with a low initial cost in the overhead.

Atlas Rock Company

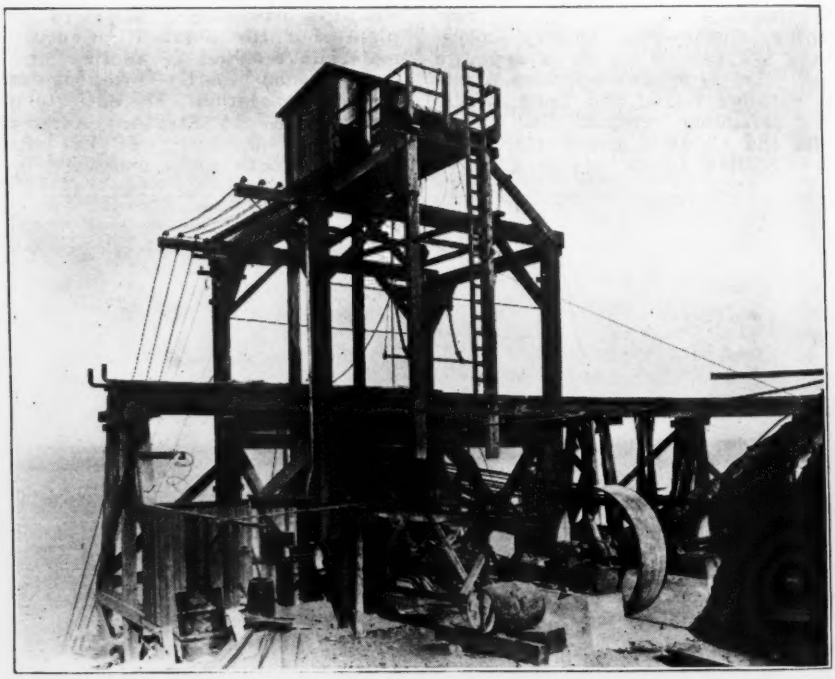
This company operates an efficient plant producing 1200 tons of sand, gravel and crushed stone daily. The capacity is about to be increased to 2000 tons daily largely through the addition of 12 yard Western quarry cars and an 18 ton Plymouth locomotive which will be used in connection with a new deposit opened up about one mile from the present plant. The present installation of Gilbert screens will make it possible to handle this increased capacity. The screening and washing operations are of special interest. By a system of belt conveyors it is possible to mix two sizes of sand and four sizes of gravel. Flexibility is a feature also. The sand and gravel plant can operate two days without the crushing plant, and the crushing plant can operate a whole day by drawing only from storage. Another feature is that any section of the Gilbert screens can be blanketed making it possible to produce any size of stone. This plant will also be discussed in one of the early numbers of Pit and Quarry.

Big Tejunga Rock and Gravel Company

This company operates an unusual plant producing 2000 tons of crushed stone, gravel and sand daily. The pit is in the shape of a crescent, and double tracks and switching arrangements are in use. A Marion steam shovel loads the material into 4 yard Western dump cars of which eight are used. Two are loaded, two are switched to position, two are going up the incline and two are coming down in the same cycle. The switching is handled by a Plymouth 7 ton gasoline locomotive which also hauls the loaded cars to the foot of a 1000 foot incline where they are pulled up to the grizzly by a double drum hoist. This plant also will be the subject of a separate article in an early number.

Granite Rock Company

This company is probably getting all that is possible out of its plant at Watsonville, California, with the result that they claim to have established a record for economical production. Blasting and drilling operations



Initial Discharge for Quarry Cars at Graham Brothers Catalina Island Plant

View of Deposit Operated by Big Tejunga Rock and Gravel Company

are a feature. There is no drilling on top of the exposed rock. Air operated drills are used with the snake hole method. The holes are loaded with 40 per cent Trojan powder which produces stone easily handled by a Model 50 Marion steam shovel which loads 12 car trains of 4 yard Western dump cars which are hauled by a 15 ton Porter steam locomotive to the crushing plant.

A production of 2000 tons of stone is secured with a number 8 and a number 7½ McCully crusher. These crushers are never idle. The overburden from 25 to 45 feet of sand and clay is removed by hydraulic stripping very efficiently. The plant has been designed as a double unit each of which can be operated independently or in combination. This plant will also be discussed in detail in a future number of Pit and Quarry.

Union Rock Company

This company is the most widely known of the Pacific Coast producers of crushed stone. Of their several plants the new plant near Baldwin Park is the most unusual. The entire structure is built of reinforced concrete and structural steel.

J. C. Buckbee Company of Chicago designed the plant and can justly be proud of their work. The plant has a capacity of 500 tons per hour and a bin storage of 5000 tons with provision made for 100,000 tons of addi-

Another View at Big Tejunga Rock and Gravel Plant

tional bulk storage which will probably be required later. Nearly two miles of private railroad trackage serves the plant. A complete water supply including a 300 foot well, a million dollar concrete storage reservoir, and the necessary pipe lines and pumps for washing is maintained. This plant will be discussed in a future number of Pit and Quarry.

Los Angeles Rock and Gravel Co.

This company has recently completed near Baldwin Park a new plant of interest because of the application of electric power to all operations except excavating. Two distinct systems of excavation are employed. A Lidgerwood electrically operated dragline with a 3½ yard bucket loads material into a hopper, and 10 yard end dump cars are loaded from this hopper by electrically controlled gates. Then loaded cars are hauled over 1500 feet of track by a Lidgerwood hoist operated by a 100 H.P. motor. In the other excavation system a Marion number 60 steam shovel with a 3 yard dipper loads sand and gravel into 30 yard bottom dump cars which are hauled by a Plymouth gasoline locomotive a distance of about 3500 feet to the foot of an incline to the plant. The 30 yard cars are hauled up this incline by a Hendy electric hoist operated by a 100 H.P. motor. This unusual operation will be the subject of an article in a future number of Pit and Quarry.

Progress on Northwest Lime

Bonds are now being sold for the construction of a new modern plant on Orcas Island for the manufacture of various lime products. This project gives a new industry to the state of Washington. Orcas Island is one of the San Juan islands in Puget Sound.

The quarry site near the village of East Sound was originally owned by a Mr. Hunter who promoted a company to operate it. His untimely death resulted in nothing more than promotion work by his company. The heirs recently sold their holdings to the Northwest Lime Company of Seattle, Washington.

Considerable prospecting has been done which shows that the present quarry will produce enough material to keep the proposed plant in operation for over eighty years at capacity. The quarry is located about 3000 feet from the kiln site and will be served by a monitor gravity plant which will transport the rock to the kiln on an inclined track requiring no power to operate. Loaded cars at the plant will dump directly into the two vertical kilns, the hydrater, or bins as desired. A 75-foot tunnel will be driven into the quarry at the lower edge of the outcrop which will give a working face of 160 feet. Raises will be put in, and the stope method of mining will be pursued. The broken lime rock will be dropped into the cars by air controlled gates.

The plant equipment will consist of two semi-automatic shaft kilns, 17x78 feet, a Schaefer continuous hydrater, crusher, the gravity plane mentioned above, dump cars, screens, and Diesel engines generating power at 440 volts for operation of the plant.

The product will be marketed as lump lime, hydrated lime, raw limestone and chicken grit. The coast trade will have to be informed regarding the use of hydrated lime, but when they know that insurance rates and storage rates are less than on lump lime and that no tempering is required for its use, a large demand is anticipated. Present indications point to a big demand for the raw lime rock for use as a flux in other industries and for the graded chicken grit. The market for lump lime is already established, so there is no hesitancy on the part of the officials of the new company in going ahead with the proposed plant.

Preliminary engineering and development work has been in charge of The Percy E. Wright Engineering Company, of Seattle, Washington, whose consulting mining engineer, Will C. Shaw, is in charge of quarry operations. Maurice T. Hopkins, economic geologist, worked in connection with this company in examining and reporting on the property.

The officers of the Northwest Lime Company are: Lawrence Keefe, President; Charles E. Clendenny, Vice President; Charles H. Graves, Secretary and Treasurer; and Dr. Charles W. Littlefield, Trustee. The Seattle offices of this company are in the Melhorn Building.

Shope Brick Factor on Pacific Coast

By E. D. Roberts

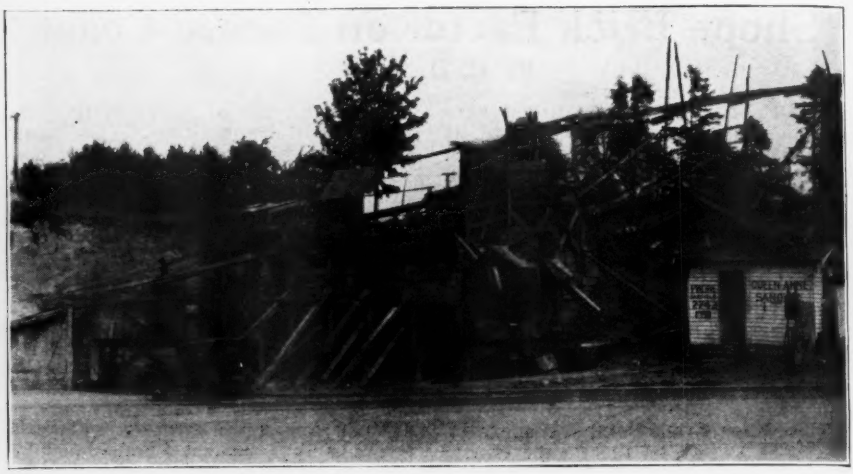
SHOPE brick is known to the non-metallic industries in general as an excellent market for by-product sand or stone screenings. The Pacific Coast also recognizes this, but in addition has approved the Shope brick as a building unit. Portland, Oregon, has thousands of buildings of all types constructed of Shope brick. It is a significant fact that Portland is the home of Shope brick. The future building possibilities of the Pacific Northwest are particularly promising. Shope brick plants are spotted all along the Pacific Coast.

The Shope Brick Company operates plants of its own on the Pacific Coast. There are numerous Shope brick plants throughout the country which operate under license from the Shope Brick Company. With this license goes a definite territory in which no other company can make Shope brick. This has proved to be a decided advantage to some sand and gravel producers who have been able to find a market for their own by-product and at the same time engage in the manufacture and sale of Shope brick without fear of competition in the same product. This condition does not prevail in the manufacture of concrete products because any other producer may enter the same territory in competition.

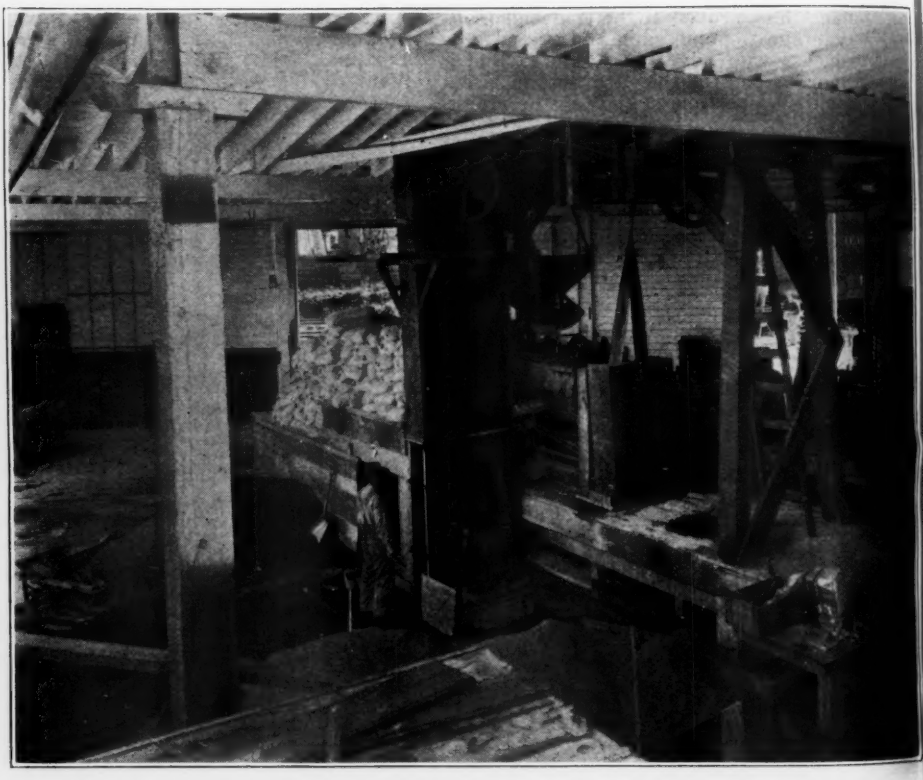
Since the Shope patents were granted, there have been improvements in methods and machinery and also new types of Shope brick. The latest Shope product is a concrete tile with one face glazed or colored. This tile is made with one face finished and can also be made with a face and one edge finished for use in corners. The tile is made by a special Shope machine which not only molds the tile but also trowels the sides while it is being withdrawn. The finished faces are treated with mineral coloring by the Shope process which produces any desired color or effect.

The home office and parent plant of the Shope Brick Company is at Portland. Mr. Shope started this plant twelve years ago for the manufacture of brick under his patents.

A Corner of Shope Brick Company Sales Room at Portland, Oregon

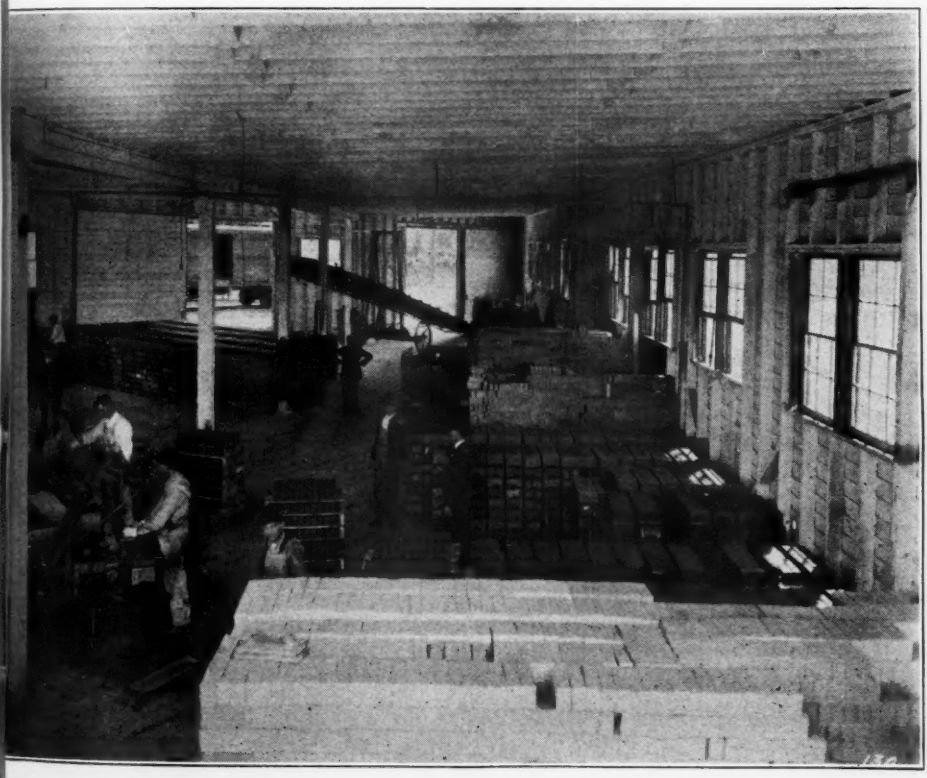


The Queene Anne Sand Storage Bins. The Trough From the Stockpile Can Also Be Seen



Interior View of the Shope Brick

The Cableway Mast and Stockpile From Which Sand Is Sluiced to Plant



ompany's Plant at Portland, Oregon

Washed sand and gravel are purchased from local operators. The gravel runs from ⅛ to ⅜ inch in size, while the sand is ⅛ inch and less. Trucks drive into the plant and dump their load of sand and gravel on the floor. The sand is then shoveled into a batching hopper as desired. This batching hopper is lowered into a hole in the floor. The aggregate is elevated on a platform three feet above the main floor of the plant. The cement is then added to this mixer which is a Blystone and thoroughly mixed for two minutes when water is added. The amount of water added depends upon whether they are to be backing brick or face brick. The face brick are hand worked later. A very dry mix is desirable as the aggregate then molds properly.

This mixer discharges to a platform which supplies the molding machines. The brick molds of the molding machine are filled by the machine operator. The brick are tamped thoroughly by an arm which carries a tamper for each brick. After tamping the surplus material is truck off; the face of the brick troweled smooth, and the mold is withdrawn.

This is sufficient for the common brick. For face brick it is necessary to mix color with the cement. Coloring matter is also sifted onto the face of the brick, the brick flushed with water and the color pounded in with special brushes. The coloring matter is iron oxide. Many designs of facing can be obtained, such as moss, tapestry, stipple, smooth or rough. Each molding machine will turn out from 4000 to 6000 common brick per 8 hour day. This brick is 2⅜x3⅝x8¼ inches in size.

After the bricks have been smoothed, they are put on a self-spacing wooden pallet. This pallet is a board with a metal top and is inserted as a bottom plate before the brick are made. It is constructed so that one batch of

Left View Shows Shope Machines and

brick can be stored over the other. Two blocks a little larger than the brick are placed under either end; and as the pallets with brick upon them are piled up, they are so spaced by these blocks that the top pallet does not rest on the brick. This is the self-spacing feature.

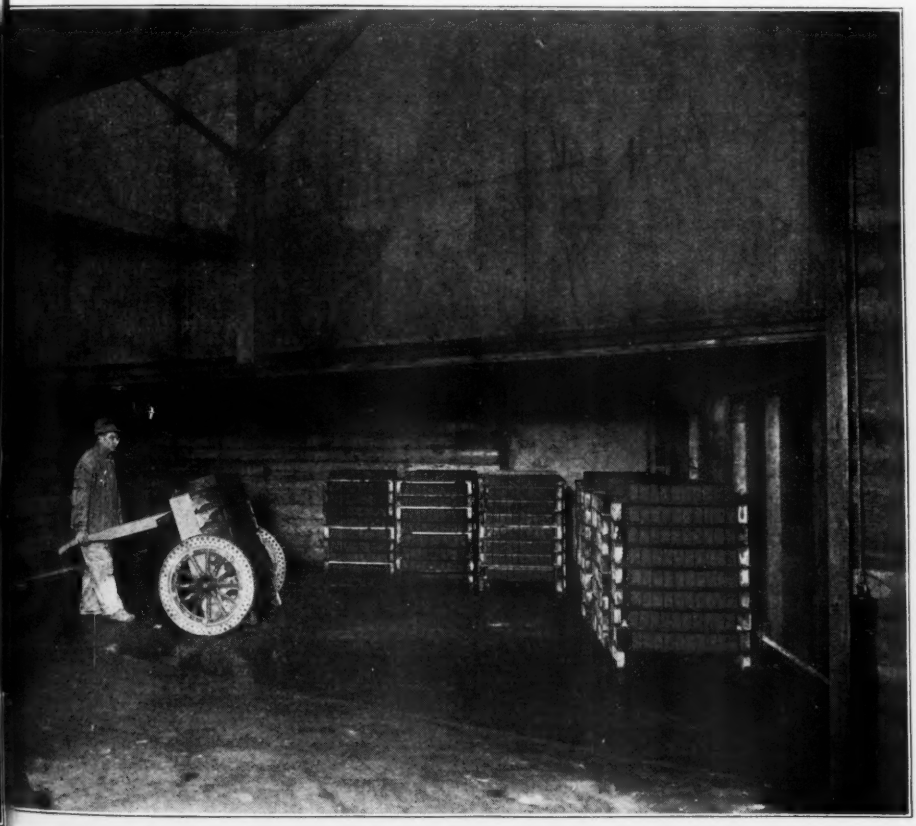
As the brick are manufactured, these pallets, which hold ten bricks, are taken out and piled nine rows high, making a stack of 90 bricks. A truck made by the Shope Brick Company picks up these stacks of brick, and a man runs them into the kiln. This truck goes under the bottom pallet, picking up the stack easily and without any jar. The trucks that do this hauling have two wheels with rubber cushioned tires so that the brick are in no way disturbed in their initial set. The common brick are left in the kiln 24 hours, while the face brick are left for 48 hours.

Each curing room has a capacity of 10,000 bricks at a time. After curing, warm air is introduced into the curing room by means of a fan. This warm air dries the brick and completes the cure.

The face brick and tile are manufactured in a separate part of the plant. Here another Blystone mixer mixes the concrete in the basement, and an elevator handles the mix to the finishing room. Alternate applications of troweling and mineral colors produce the desired effect, while the brick is still in the mold. The mold is withdrawn as in the case of the common brick leaving the brick on the pallet which is handled to the curing room and treated in the same manner as the common brick.

The common brick are made only on order, while the faced brick are generally made in advance and a stock maintained. One operator will turn out from 700 to 900 face brick in an 8 hour shift, according to the finish desired.

Face brick are greatly desired for



ck Ready to Enter the Curing Room, Which Is Shown in the Right View

mantles, fireplaces and hearths, because of the unlimited designs which can be worked out and because of the fire resisting qualities. Tile for bathroom finish is also produced as the Shope brick that is finished is waterproof.

There is another Shope brick plant at Seattle known as the Shope Brick Company of Seattle. In connection with this plant they control the Queene Anne Sand Company of the same city. The interesting connection in this case is that the only pit sand produced in Seattle is produced by the Queene Anne Sand Company. The salt water in the other sand has a tendency to discolor the brick.

This sand operation is on the north slope of Queene Anne Hill in the city of Seattle at Third Avenue and Fulton Street. The deposit covers about eight acres, and the strange glacial action in this territory left this area free from large stones. The sand runs from pea gravel to fine plaster sand.

A Sauerman ¾ yard drag scraper operated by the Pacific hoist driven by a 75 H.P. General Electric motor excavates the sand and discharges to an outside stock pile. This stock pile is ahead of a flume which carries the sand to the screening plant. The sand is washed by water into the flume and carried to the screening plant.

The screens are placed over the bunkers. The first screen is placed with an inclination towards the side causing the pea gravel to fall into the gravel bin. Two other screens placed in the bottom of the trough grade the sand still further. These sands fall into boxes in which water is jetter from the city mains which thoroughly washes and scrubs them. When the box is full and thoroughly washed, gates are opened in the sides of the boxes causing the sand to fall into the loading bin below. The sand is drawn from here into trucks by means of gates in chutes at the bottom of the bins. In this manner 160 to 180 yards are produced in an eight hour shift with four men operating the plant.

The special product of this plant is what they call "Superfine Sand" which is finer than the ordinary sand but very sharp. It has a velvety feeling to the touch and is much sought after for plastering purposes. It is also used extensively for sand blasting and finishing of cement work. The sand for use in the manufacture of the Shope brick is hauled to the factory and dried there before use. The company operates a fleet of five large trucks, handling the sand and pea gravel to the brick plant and making other deliveries as required.

The Queene Anne Sand Company is controlled by the Shope Brick Company of Seattle. W. C. Bickford and C. N. Frost are partners in this enterprise with the brick business under the direction of Mr. Bickford and the sand business under the direction of Mr. Frost.

In this case we have a practical illustration of the "hook-up" in the nonmetallic industry between the Shope brick plant and a sand and gravel plant. The simplicity of the Shope process, the absence of expensive equipment, the territory protection and the excellent uniform brick make it a profitable business and an excellent adjunct to the sand and gravel business. This would also apply to many crushed stone operations where screenings are a waste.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,550,013. Crushing-mill. Arthur C. Daman, Denver, Colo.

1,550,087. Mining-machine. George W. McNeil, Denver, Colo.

1,550,699. Core-breaker for mining-machines. Newton K. Bowman, Bowdil, Ohio.

1,550,938. Excavating-machine. Daniel J. Walsh, Pittsfield, Mass.

1,551,836. Loading apparatus. Edmund C. Morgan, New York, N. Y.

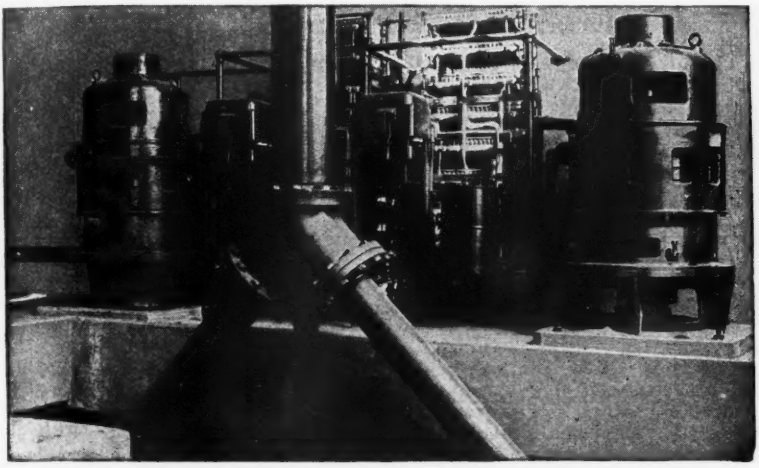
1,552,033. Excavating-shovel. Herman J. Brendlin, New York, N. Y.

1,552,458. Crushing concave and mantle. Edgar B. Symons, Los Angeles, Cal., assignor to Symons Brothers Co., Milwaukee, Wis.

1,552,571. Mine-car. Hugh W. Sanford, Knoxville, Tenn.

1,552,909. Mining-machine. Harry L. Brown, Glen Ridge, N. J.

1,553,062. Slewing-gear for dragline excavators, grab-excavators, revolving shovels, and the like. Oswald Bedgood, Glasgow, Scotland, assignor to Lobnitz & Co., Ltd., Renfrew, Scotland.



Morris Pumps were selected to handle the slurry at the new Peerless Portland Cement plant, Detroit

A 6-in. Morris Vertical Pump transfers the caustic soda waste to the wash mills, from which the mixture of clay and waste is handled to the raw grinding department by a 3-in. Morris Vertical Pump. The discharge from the grinding mills goes through a 5-in. Morris Horizontal Pump to the correcting basin and from there the slurry is handled to storage in the kiln building by an 8-in. Morris Vertical Pump.

Each pumping stage is served by twin pumping units, one for regular service and the other for standby, and all these pumps are of manganese steel throughout, to resist abrasion.

The New Egyptian Portland Cement plant at Port Huron, Mich., is also equipped with Morris units at every slurry-pumping stage.

Experienced cement mill engineers know from Morris past performances that Morris Manganese Pumps will "stand the gaff."

Morris Engineers are qualified to make correct recommendations. Their advice and our literature are both free for the asking. Tell us your needs.

Morris Machine Works **Baldwinsville, N. Y.**

Originators of Centrifugal Pumps, both single and multi-stage, and builders for practically all purposes since 1864

Branch Offices: New York, 39-41 Cortlandt St.; Philadelphia, Forest Bldg.; Cleveland, Engineers' Bldg.; Chicago, 217 N. Jefferson St.; Boston, 79 Milk St.; Pittsburgh, 320 Second Ave.; Detroit, Penobscot Bldg.; Charlotte, Realty Bldg.; Richmond, 708 Mutual Bldg.; Houston, 119 Main St.

Sales Representatives: Buffalo, St. Paul, Kansas City, Denver, Salt Lake City, Seattle, Portland, Ore., Los Angeles, New Orleans.

MORRIS
CENTRIFUGAL PUMPS

Promoting a Friendly Public Spirit

SEATTLE fosters an organization which might well serve as a pattern for many other similar groups which could be organized to advantage throughout the country. The Seattle Mining Club conducts weekly luncheon meetings of mining men. There are no restrictions upon attendance; everybody is welcome who is interested in mining or quarrying or in the development of the industry. The club was started by Seattle men who realized the importance of the mining industry to the city. They sought first to assemble and develop acquaintance among the several hundred mine operators, engineers, prospectors, coal, clay and other miners who have their headquarters in the city but were not organized or even acquainted among themselves. The results have been most gratifying and productive of much good. Programs are arranged for each meeting. Free and open discussion is encouraged among all those who attend in response to the general invitation extended. Action can be taken only after the approval of a Board of Trustees composed of fifteen representative mining and business men. It has already demonstrated its influence in the increased interest in mining, both metallic and non-metallic, which has been aroused in the city and is bearing fruitful results.

The objects of the club are best stated in its Declaration of Purpose "to encourage mine development in the regions tributary to Seattle, to promote a friendly and helpful public spirit toward all legitimate development enterprise, to extend acquaintance and provide a means of social intercourse among those engaged or interested in mining, to distribute information and facilitate discussion and the exchange of ideas, to aid especially the prospector and pioneer developer, to expose fraud wherever masquerading in the name of mining, to foster public confidence and good will toward those engaged in mining, and to help maintain forever the dauntless spirit and high ideals of professional ethics which have ever distinguished that legion of public benefactors whose life records are the noble heritage and priceless treasure of mining men."

The officers of the club are: Maurice D. Leehey, mining lawyer, President; William J. Elmendorf, mining engineer, Vice President; and Charles D. Garfield, Secretary. Mr. Garfield has charge of Alaska affairs in the Seattle Chamber of Commerce. The Board of Trustees includes such well known Seattle and Alaska mining men as Thomas Davis, John D. Hull, Falcon Joslin, Robert Nielson, Dean Milnor Roberts of the College of Mines at the University of Washington, John C. Haas, Chester F. Lee, L. A. Levensaler and Harry Townsend, mining engineers, Dorsey Hager, petroleum engineer, M. C. Butler, coal mine operator, M. J. Falkenberg, metallurgist, while the conduct of its meetings has been largely managed by Joun P. Hartman, Percy F. Wright, Colonel W. T. Perkins and William C. Shaw.

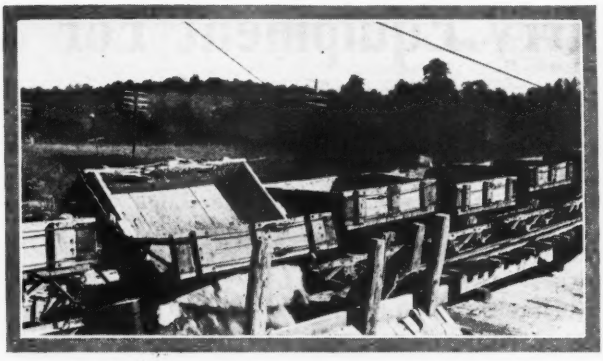
Elsewhere in this number we have published three papers read and discussed at three successive meetings of the Seattle Mining Club presided over by Mr. Wright as Chairman. Such an enterprise as the Seattle Mining Club merits highest commendation. Its Declaration of Purpose reveals the fundamental principles upon which it is founded and the earnestness of purpose and integrity of its members.

Power Plant Bulletin

The Diamond Power Specialty Corporation has reprinted a very striking bulletin entitled "The Best Paying Investment in the Power Plant." This bulletin features Diamond Valv-in-Head Blowers, and contains information and data which should be of interest and value to the power operator. Copy may be obtained by addressing the Diamond Power Specialty Corporation, Detroit, Michigan.

Electric Transformer Bulletin

The Kuhlman Electric Company of Bay City, Michigan, have recently published a very interesting handbook on the electrical transformer. This bulletin is out of the ordinary in that the manufacturer does not talk about his product in the text. The new Kuhlman bulletin is brimful of practical engineering data and material for the electrical or consulting engineer, and the man who operates transformers.



These Western Dump Cars Have Worked 15 Years

Scarred and battered by 15 years' battle with limestone rock in a Massachusetts quarry, the Western dump cars in the above picture are still going strong, and there is plenty of service in them yet!

The Western dump cars of today are far better cars than those shown above. The end construction and doors, for example, are greatly improved. But even supposing they **weren't** better today—would you ask better service of **any** equipment than the Western cars in the picture have given?

Western dump cars are available in all sizes from 1½ yards to 50 yards. We shall appreciate an opportunity to tell you more about them.

Western

SUCCESSFUL PERFORMANCE FOR A GC ★ A

Western Wheeled Scraper Company

Founded 1877

Earth and Stone Handling Equipment

AURORA, ILLINOIS

Quarry Equipment For Sale

IMMEDIATE SHIPMENT

Having purchased the Buildings and Equipment of Quarries located at Lemont, Ill., we are offering everything at prices that should result in speedy sale. Partial list follows:

Gates Crushers Nos. 3, 4, 5, 6, and 7½
Gates Elevators
Lidgerwood Hoists
Screens and Rolls
Compressors and Condensers
Engines, Boilers, Derricks
Tool and Harness Shop Supplies
Relaying Rails, Frogs and Switches
Pit Cars
Pipe

We solicit your inquiries for the above equipment and urge prompt action as it is priced to move quickly.

Merchants Steel & Supply Company

208 South La Salle St. **Chicago, Illinois**

FOR SALE

SURPLUS EQUIPMENT

1—Model 24 Bucyrus Dragline (No. 903), 115-ft. boom, 3½ cu.yd. bucket, steam power, mounted on skids and rollers.

1—Model No. 6 McMyler Locomotive Crane (No. 3315), 30-ton, 50-ft. boom.

Jackarm outriggers, one kw. lighting generator, 1½-yd. type "R" clam shell bucket, J crane.

1—Model No. 5 McMyler Locomotive Crane (No. 3359), 25-ton, 50-ft. boom, double power drums, enclosed steel cab, M.C.B. trucks, Jackarm outriggers, 1½-yd. type "R" clam shell bucket.

1—Model No. 37 Marion Dragline and Shovel, (No. 4888), mounted, two belt rigid caterpillar trucks, 32-ft. boom, 22-ft. handle, high lift, 1¼-yd. dipper. Dragline forward drum complete 50-ft. boom.

1—Hayward (No. 5930), 2-yd. Clam Shell Bucket.

1—Type "O" Austin Trench Machine (No. 568), gasoline power.

1—5-ton Holt Tractor.

1—Plymouth Gasoline Locomotive, 24 ga.

2—Orr & Sembower Vertical Steam Hoisting Engines.

1—No. 5 Pulsometer Steam Pump.

1—6-in. Swaby Centrifugal Steam Pump.

1—No. 6 McKiernan Pile Driving Hammer.

2—Steam Locomotive and Tenders, 18x24-in. cylinders 63-in. drivers, 88,800 lbs. weight on drivers, 126,820 lbs. weight of engine loaded, 110,000 lbs. weight of tender loaded, total heating surface 1222.3 sq. ft., grate area 33.9 sq. ft., 23-ft. 2¼-in. wheel base engine, 50-ft. 2½-in wheel base engine and tender, 60-ft. 7½-in. total length engine and tender, 18,600 lbs. tractive power, 175 lbs. boiler pressure.

2—20-yd. Western All-steel Automatic Air Dump Cars, standard gauge, wood floors, ¼-in. steel lining specification 20009, bought new January, 1925.

12,500 ft. double rail single track, 80-lb. relaying rails, fish plates, switches, new No. 1 oak ties. All in first class usable condition.

All of the above equipment has been used by ourselves in the construction of Connors Creek Sewer at Detroit, Michigan, and is in first class working condition. Ready for inspection at above location. Additional details on request.

LENNANE & McILVENNA

BOOK BUILDING, DETROIT, MICH.

"WE BUY—REBUILD—SELL OR RENT"

HOISTS

Large quantity late model American double-drum with attached swinging gear, capacity 6000 pounds; on a single line at 162 ft. per minute; either hand levers or levers banked in quadrant.. Can furnish either 37 H.P., 440 or 220 volt, A.C., 60 cycle, 3 phase, alternating current, or 35 H.P., 220 volt, direct current, or can furnish without electrical equipment suitable for gasoline or belt drive.

CABLEWAY EXCAVATORS

1—Complete Sauerman Cableway Excavator, ¾-yd. bucket, cable, sheaves, etc., for 1000 ft. span and 8¼x10 Sauerman special 2-speed steam hoist.

1—¾-yd. Sauerman type X special heavy excavator bucket with manganese teeth.

2—"Dull" 1¼-yd. Excavator Buckets.

STEAM SHOVELS

3—78' late '23 models, 30-ft. boom, 19-ft. dipper stick, 3-yd. dipper, one on railroad trucks, two on caterpillars.

1—Type "B" Erie on caterpillars, ¾ yd. bucket.

DERRICKS

Large quantity late model American Stiff Leg Derricks, mast 14x14x40 ft., booms 14x14x60 ft., stiff legs 14x14x50 or 60 ft., sills if desired, with 12 ft. steel bull wheel, for hook work or bucket operation.

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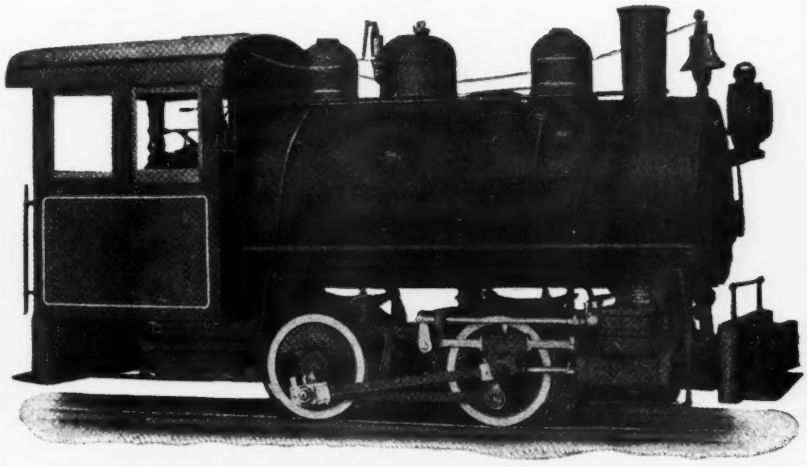

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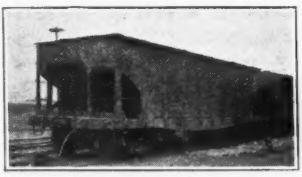

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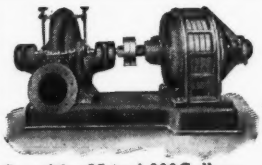

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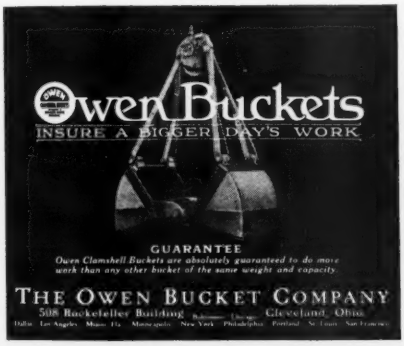
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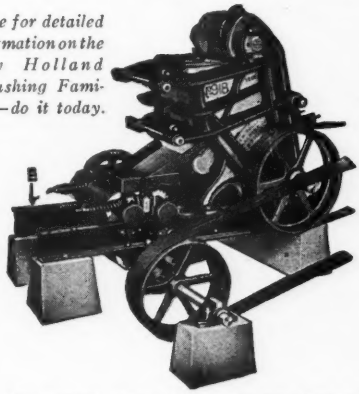

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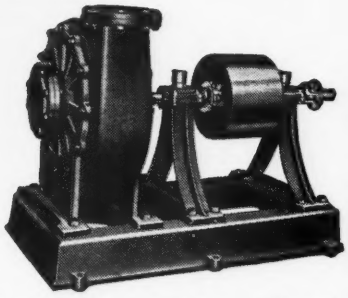

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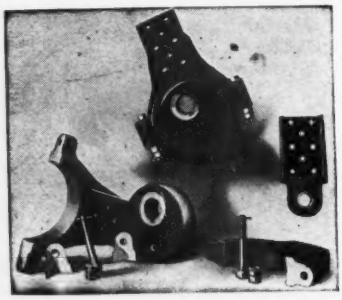

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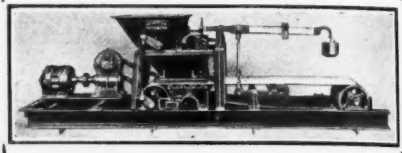

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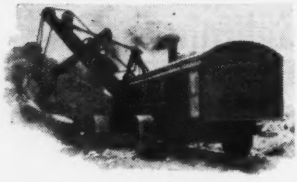

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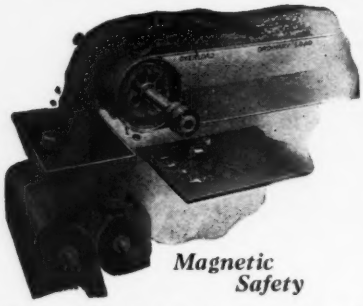

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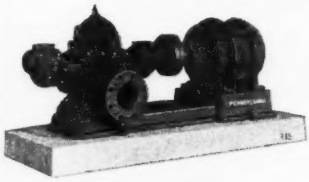
PENNSYLVANIA

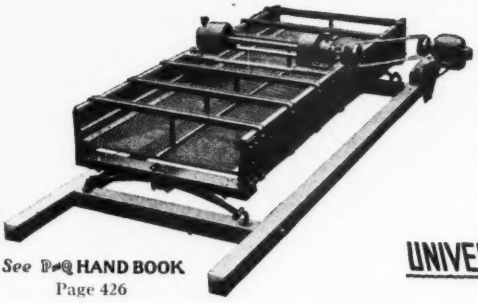


A flooded quarry means lost time. Pennsylvania Pumps may be depended upon to give reliable service.

Fully described in Bulletin No. 206-P

Pennsylvania Pump & Compressor Co.
Main Office and Works: Easton, Pa.

For Separating Dry Ground Materials
80 Mesh to 350 Mesh
GAYCO CENTRIFUGAL SEPARATORS
Six Sizes—30 Inch to 14 feet Diameter
RUBERT M. GAY COMPANY, Inc. 114 Liberty St., N. Y.

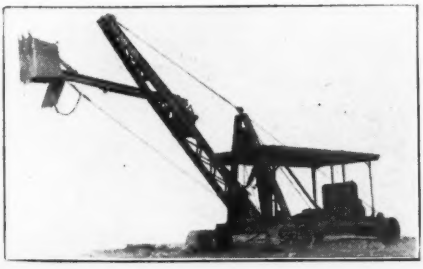


See P&Q HAND BOOK
Page 426

Universal Vibrators
For the very highest screening efficiency with the lowest maintenance cost.

Write for Descriptive Catalog Today.

UNIVERSAL VIBRATING SCREEN CO.
RACINE — WISCONSIN



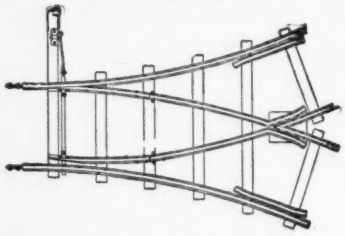
BAY CITY ONE MAN EXCAVATOR
Operates Shovel—Clam—Dragline ½-yd. Capacity
Fills the gap between hand labor and high priced equipment. Several hundred in operation, gasoline or electric power.

BAY CITY DREDGE WORKS
BAY CITY, MICH.
See P&Q HAND BOOK Page 333

Kilby Frog and Switch Company

Birmingham, Alabama

Manufacturers of



We make a specialty of track material for all kinds of Industrial Tracks—such as Frogs, Switches, Switch Stands, Rail Braces, Crossings, Crossovers, Room Turnouts, Portable Track, Etc.

Write for Catalogue.

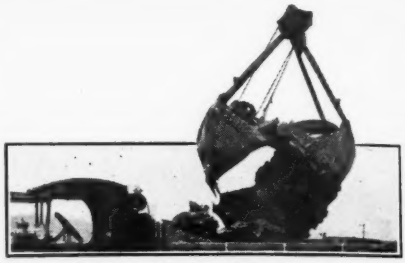
Green Power Drag Scraper

This Power Drag Scraper will stand up under the most trying condition on any sort of job. It makes good on large capacity requirements and at a low cost of operation.

Proofs of successful performances are in our catalog. Send for your copy.

L. P. GREEN

Monadnock Block Chicago, Ill.



Dreadnaughts *are* Everywhere

You'll find Blaw-Knox Dreadnaughts railroading; contracting; road building; in steel mills—wherever clamshell work is being done.

Rehandling and digging costs are *lower* when Blaw-Knox Buckets are on the job

BLAW-KNOX PRODUCTS Rollerpiate Measuring Rollers Retrieval Forms Road Forms Clamshell Buckets Turntables Steel Subbases

BLAW-KNOX COMPANY

Farmer's Bank Bldg. Pittsburgh, Pa

BLAW-KNOX

BUCKETS

No Counterweights!

All the weight is built right into the bucket—you get DEPENDABILITY when you use a WILLIAMS. All parts guaranteed against breakage, as long as the bucket is used on the classes of work for which we recommend it.

G. H. WILLIAMS COMPANY

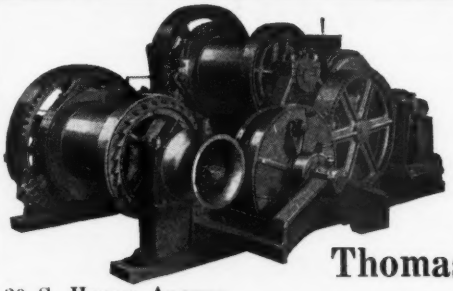
605 Haybarger Lane, Erie, Pa.

Eastern Sales Office : 30 Church St., New York City

WILLIAMS

FAST-DIGGING BUCKETS

All Parts Guaranteed Against Breakage



Thomas Hoists

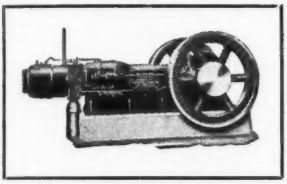
Steam and Electric

Single and two-speed types designed and built to meet every requirement of the Sand, Gravel and Stone Producer.

Thomas Elevator Company

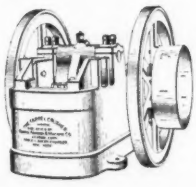
20 S. Hoyne Avenue — Chicago, Illinois

Buckeye Oil Engines Are Favorites



Single and two cylinder 55 to 260 H. P.
Horizontal accessible design with adjustable cross-head.
Cost least for repairs.
Burns low grade fuel.
One gallon lubricating oil operates 90 h. p. for 33 hours.
Write for catalogue.

THE BUCKEYE MACHINE COMPANY — **Lima, Ohio**



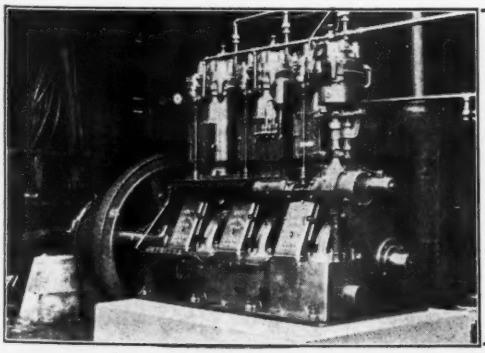
"FARREL" CRUSHERS

—World Famous—

Thousands in use on the hardest rock. Built in all sizes, 6″x3″ to 60″x48″. Complete rock crushing plants designed and equipped, also sand and gravel, washing and screening plants.

Send for latest bulletin E.

Earle C. Bacon, Inc., Engineers, 26 Cortlandt St., New York



TIPS OIL ENGINES burn low grade fuels. Solid Injection. 40—165 H.P. Sizes suitable for operating dragline excavators, hydraulic dredges and all stationary work. Variable speed, 100% water-cooled heads, no torches, Chrome-Vanadium crankshafts.

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TIPS ENGINE WORKS

AUSTIN, TEXAS

Agents in all principal cities

DRILLS—WooD—*DRILLS*

Wood Drills cannot be surpassed. They have a combination of quality and durability that is bound to please. The ease of operation and the rapid, hard biting, drilling ability will give you the results you want. Write now for details and prices.

WOOD DRILL WORKS, 30-36 Dale Ave., Paterson, N. J.

Makers of Hammer Drills and Piston Drills

Crushing and Grinding
Material Handling
Old Equipment Modernized
Properties Examined

C. H. SONNTAG
Engineer
Cape Girardeau, Mo.

Portland Cement Plants
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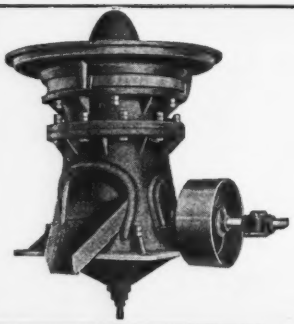
PULVERIZERS

FOR AGRICULTURAL LIMESTONE
ASPHALT FILLER
ROCK DUST FOR MINES
THE GRIFFIN MILL—BRADLEY 3 ROLL
BRADLEY HERCULES MILLS
OUTPUTS—1-40 TONS PER HR. FINENESS—20-200 MESH.

BRADLEY PULVERIZER COMPANY
BOSTON Works: ALLENTOWN, PA. LONDON



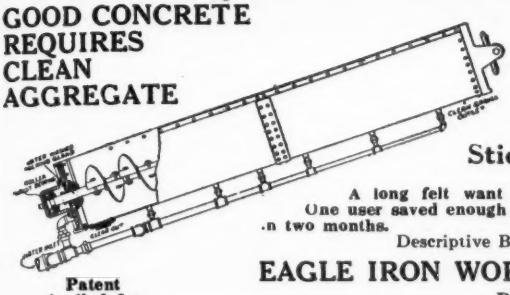
AUSTIN
Gyratory Crushers
Portable and Stationary Plants

Capacities, 5 to 300 tons per hour

Catalog 29Q tells the whole story. Write for your copy today.

AUSTIN MANUFACTURING CO.
NEW YORK CHICAGO SAN FRANCISCO

GOOD CONCRETE REQUIRES CLEAN AGGREGATE



Patent Applied for

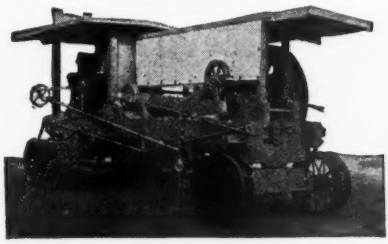
The EAGLE WASHER

Removes Mud Balls, Sticks, Coal and Shale.

A long felt want that actually does the business. One user saved enough to pay for the cost of this washer in two months.

Descriptive Bulletin now ready.

EAGLE IRON WORKS, Des Moines, Iowa
DEPT. P



The "CLIPPER"

late improved Blast Hole Drill. The "CLIPPER" predominates, has stood the test, and is approved by critics. Furnished also in the round wheel.

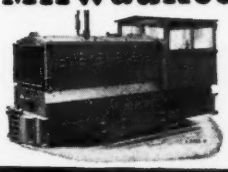
(Established 1842)

LOOMIS MACHINE CO., 15 Market St., Tiffin, Ohio

THE SCHULTHESS HYDRATOR—Built in all sizes to suit condition—Takes lime direct from the Kiln without crushing—Lowest possible power required—about one-third the amount used by other Hydrators—Entire elimina

Milwaukee Gasoline Locomotives

For Industrial Haulage



BUILT in sizes from four to fifteen tons. For all Gauges of Track. There's a size for every purpose.

Write for Catalogs M-129 and M-136.

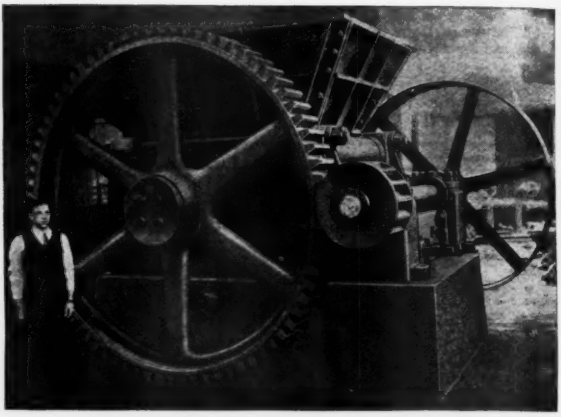
MILWAUKEE LOCOMOTIVE MFG. CO. MILWAUKEE WISCONSIN

Product of Practical Crusher Experience

There are many rock crushers on the market for which various claims of superiority are made. The McLanahan Single Roll Crusher has the advantage of a third of a century of crusher experience behind it. In addition to this it has very particular qualification for use in certain branches of stone crushing.

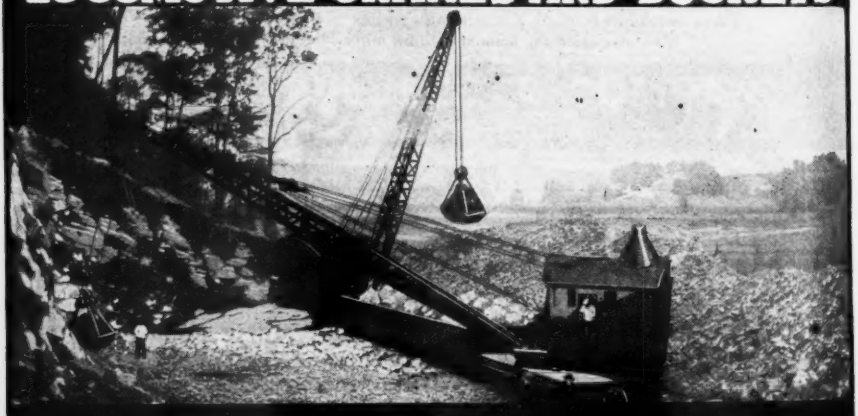
The smaller crushers—5 to 50 tons per hour—is the ideal phosphate rock crusher. Over 50 are in use in Florida on hard rock. The large capacity machine was built to replace gyratory and jaw crushers on limestone for blast furnaces and railroad ballast. These are strong and well built machines.

Let us tell you about our crushers, screens, washers, elevators and other equipment.



McLANAHAN-STONE MACHINE CO.
HOLLIDAYSBURG, PA.

BROWNING
LOCOMOTIVE CRANES AND BUCKETS



The Browning Crane Company
16226 Waterloo Rd., Cleveland, O.

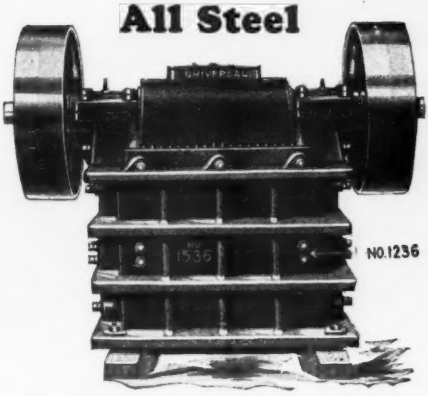
MAKING GOOD

IN the preparation of fine road materials from the hardest stone in the Pacific Coast region is only one of the great accomplishments of

UNIVERSAL CRUSHERS

25 Sizes to choose from

All Steel



Representatives in the principal western cities
Write for information

UNIVERSAL CRUSHER COMPANY
631 C Avenue West — Cedar Rapids, Iowa

EASTON QUARRY CARS

Type 5592

Competition

The buyer decides whether competition shall become destructive or constructive. No competition is so destructive to progress as that in which the relative merits of two cars are measured on on a "cents per pound" basis.

EASTON CAR & CONSTRUCTION CO.
Kansas City, Mo., and Easton, Pa.

New York, N. Y. — Philadelphia, Pa. — Chicago, Ill.
Richmond, Va. — Pittsburgh, Pa. — San Francisco, Cal.

EASTON CARS

FOR EVERY PIT MINE & QUARRY

Quarry face 1,600 feet long and 50 feet high being broken up by means of explosives detonated with Cordeau-Bickford

For one or for two hundred drill holes, use the safe, sure, and efficient detonating agent, Cordeau-Bickford. Even though you have no power line, you can still shoot any number of holes you desire by using Cordeau-Bickford.

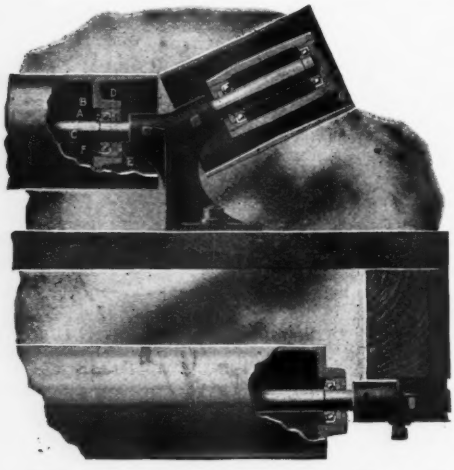
Write for booklet today.

The Ensign-Bickford Company

Original Manufacturers of Safety Fuse

Established 1836

SIMSBURY, CONNECTICUT



7 Reasons for Excelling

Hardened steel "Cone" fitted on turned steel shaft.

Pressed steel "Ball Returner" Turned Steel Shaft, set screened in Idler Brackets. Oiled washer of felt or corded wool. Hardened Steel "Plug," screwed into pulley hub.

Brass plug for lubrication.

Lock screen to prevent hardened plug from turning.

Conweigh Ball Bearing Troughing and Return Idlers represent a detail improvement which affects the whole conveying system of a plant. Because of the smooth, easy service they give, belt conveyors operate with far greater efficiency.

Conweigh Ball Bearing Idlers are smooth running, and durable, being made of hardened steel well reinforced. They give easy access for lubrication.

Get complete details on "Conweigh" Idlers. Made in all sizes. Write today.

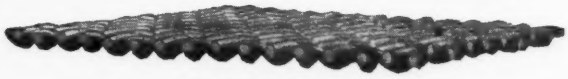
THE CONVEYING WEIGHER COMPANY

90 West Street ENGINEER & CONTRACTOR New York

TRADE ROL-MAN MARK

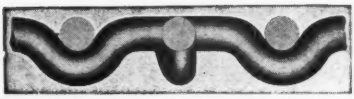
WOVEN MANGANESE STEEL SCREENS

Highest Efficiency—Greatest Economy—Longest Life



Note Face of Screen is flat

Both rods crimped preventing displacement.



Note closed double locked mesh.

Enlarged section through centre of mesh.

The Crimping is all on one side of screen. Makes wearing side smooth and flat. Will handle 50 to 100% more material than perforated plate.

Made in all shapes and sizes—Flat, Rolled to Circles or Cones.
To Fit ANY Revolving, Shaking or Vibrating Screen.

Manganese Steel Forge Co.

Richmond & Erie Ave.,
PHILADELPHIA, PA.

Manufacturers of "ROL-MAN" Rolled and Forged Manganese Products

SAND ROCK

DRYERS

"BUCKEYE SPECIAL"

Semi-Portable — Compact — Self-Contained
Oil Fired — Rugged Construction — Heavy Duty Service

No elaborate foundations required to erect this Dryer. We ship it to you assembled complete. Set it on simple concrete piers, and it is ready to operate.

Built in Six Standard Sizes

5 tons per hour to 50 tons per hour capacity.

Furnished with or without elevating machinery.

Write us for full information and prices.

THE BUCKEYE DRYER COMPANY

1351 Railway Exchange Bldg. **CHICAGO, ILL.**

FOR
DRAG LINES
POWER SHOVELS
DERRICKS

AMERICAN
STEEL & WIRE
COMPANY

Chicago New York

A REAL PUMP!

Whatever it may be that you have to remove in clayey, limey, or muddy water—the "DOMESTIC" Pump will carry it away. Contractors and quarry men find it an invaluable asset.

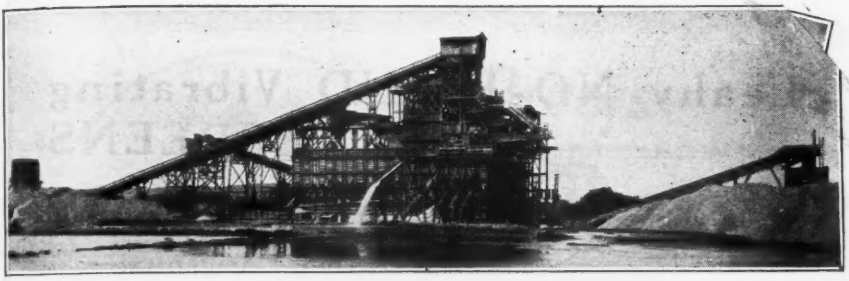
No odor or slop around the "DOMESTIC" Double Acting Trench Force Pumps. Will pump out pit or quarry bottoms, and discharge through long lines to disposal point. Maximum capacity—minimum weight.

If you have too much water or not enough at your plant, there is a "DOMESTIC" Pump for your job which will prove useful and economical.

Write for Bulletin "TP" when you have a pumping problem to solve.

Domestic Engine & Pump Co.

Shippensburg, Penna.



Service Rock Company's 3000 Ton Plant

This large new up to date plant designed and built by Bodinson engineers. All conveyors, screens, feeders, gates, etc., furnished and built by us. The plant being located in gold producing country, is equipped with up to date riffles for saving of all gold coming up with the gravel.

Twenty-five years of experience, practical and scientific knowledge are back of Bodinson Engineers when your problems are referred to us.

BODINSON MANUFACTURING CO., Inc.

ENGINEERS
11 Minna St., San Francisco
Conveying, Elevating, Screening, Mining and Power-Transmitting Machinery

BODINSON MFG. CO. SAN FRANCISCO LOS ANGELES CALIF. SERVICE • QUALITY

MANUFACTURERS
335 So. San Pedro St., Los Angeles
Labor Saving Machinery

SPEARWELL MOGUL LOADER

A Strictly One Man Machine

CAPACITY 1½ to 2½ CU. YDS. PER MINUTE
Weight 14,000 lbs.

Equipped with positive and efficient excavating, feeding and cleanup device.

Clears path 8 feet wide.

Guaranteed to excavate harder material and to clean up better than any loader of its kind on the market, bar none.

40 H.P. 4 cyl. Heavy Duty Buda Motor.

Positive self-cleaning track, 1500 square inches of bearing surface, less than 10 lbs. per square inch.

Digging and crowding speeds 4 and 20 ft. per minute. Traveling speeds ½ to 2½ miles per hour.

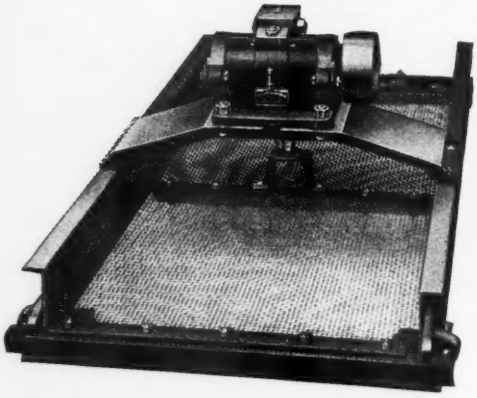
Digging position quickly and easily adjusted and absolutely maintained by special grade control shoe.

Swivel chute controlled from operator's platform, permits loading in any position.

Write for literature and prices on Spearwell Loaders—a size for every need.

SPEARS-WELLS MACHINERY CO.
Manufacturers of SPEARWELL CONSTRUCTION EQUIPMENT
Oakland, California

Leahy NO-BLIND Vibrating SCREENS



Will Screen Anything— Wet or Dry

VERY LOW POWER CONSUMPTION ½ H. P.

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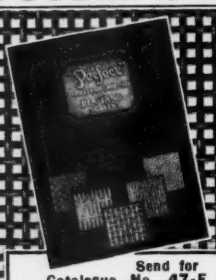
THE DEISTER CONCENTRATOR COMPANY

635 High Street
FORT WAYNE, INDIANA

New York Office:
60 Water St.

DOUBLE CRIMPED WIRE CLOTH



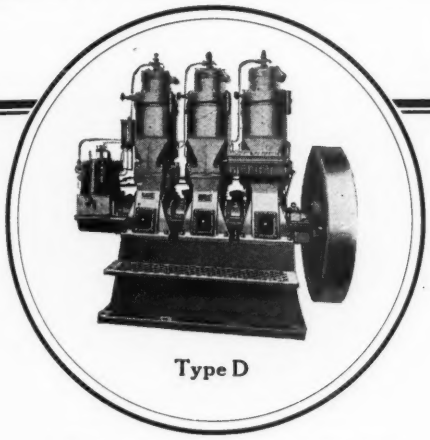
Send for Catalogue No. 47-E
It lists a thousand screens.

"Perfect" Service

1 Most COMPLETE wire cloth SERVICE
2 Most ACCESSIBLE wire cloth SERVICE
3 Most RELIABLE wire cloth SERVICE
4 Most ADAPTABLE wire cloth SERVICE
5 Most ECONOMICAL wire cloth SERVICE

The LUDLOW-SAYLOR WIRE COMPANY St. Louis
610 South Newstead Avenue

VENN-SEVERIN OIL ENGINES



Type D

A Venn-Severin Type "D" Oil Engine will meet any power requirement in pit, quarry or plant. Send for specifications.

Proofs—

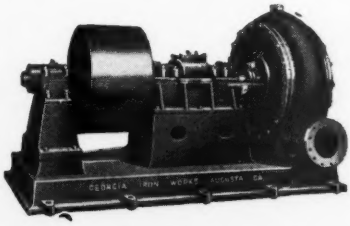
Extensive claims of superiority for the Venn-Severin Oil Engine would not bear weight unless they could be well substantiated. The excellent performance of Venn-Severin engines has resulted in numerous expressions of satisfaction from users which are available upon request.

The type "D" Venn-Severin Oil Engine is the only oil engine that operates on low compression, without water injection.

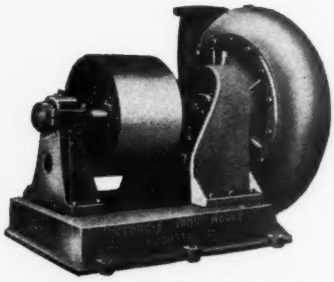
Clean combustion — no carbon — guaranteed. Built in sizes 15 to 250 H.P.

Venn-Severin Machine Co., 1317 W. North Ave., Chicago

THE ECONOMICAL POWER UNIT



Heavy duty belt driven sand and dredging pump built in 8", 10", and 12" sizes.



Overhanging type belt driven sand and dredging pump. Built in 6" and 8" sizes.

SAND PUMPS

The accompanying cuts show two very popular types of belt driven units. These pumps are also built with bases for direct connection to motor.

Send for illustrated catalog showing our complete line of this equipment including flanged pipe fittings and hydraulic guns.

GEORGIA IRON WORKS
AUGUSTA, GA.
Established 1891

SALEM
Genuine
Elevator Buckets

Since 1880, when Salem Buckets were awarded First Premium for superiority, no other make of bucket has approached the Salem in quality, long wear and unusual service. It is made in many different sizes and gauges of steel ranging from 24 gauge to 6 gauge, and is adaptable for handling materials of practically any size, shape or weight.

Our ability to furnish special buckets made up in accordance with your specifications enables us to offer excellent service and prompt delivery.

Write for Catalog 3625

Fig. 1081. Reinforced edge. Particularly suitable to light or medium gauge buckets for handling abrasive or otherwise difficult material.

Fig. 1076. Flat Bottom Open End Shelf Bucket. For handling wet, sticky substances that will not discharge readily from other styles of buckets.

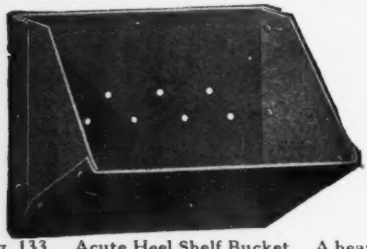


Fig. 133. Acute Heel Shelf Bucket. A heavy duty bucket especially adapted for handling coal, stone, cement, ores, etc. May be attached to chain or belt.

Mullins Body Corporation

Successor to
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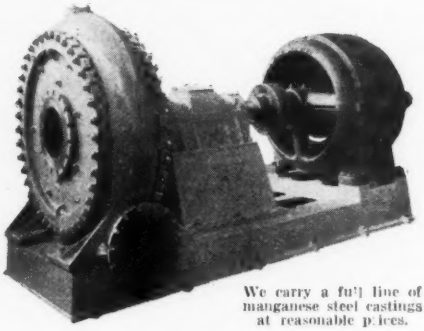

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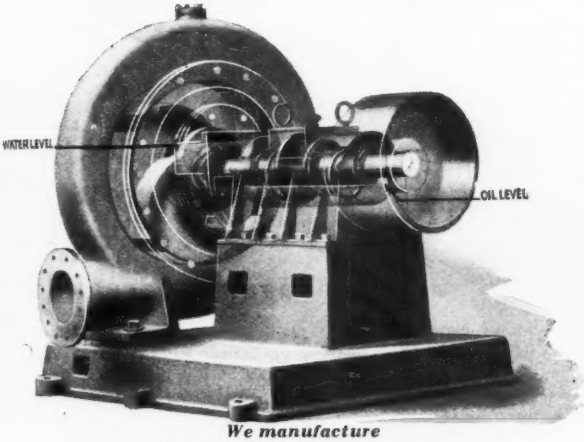

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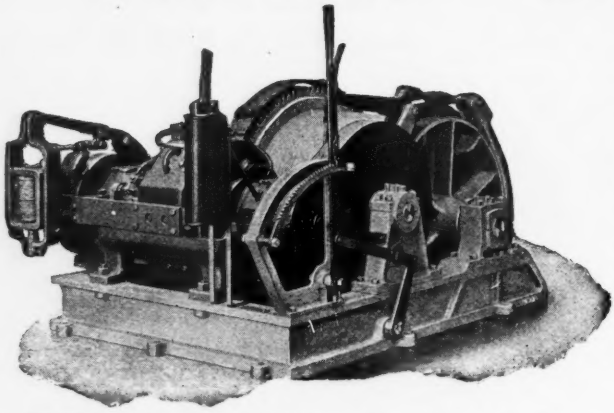

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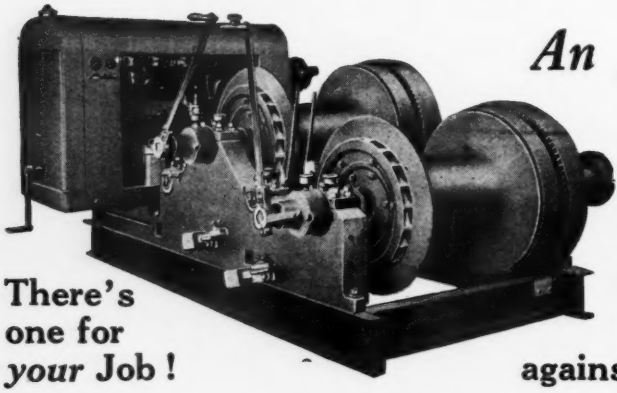

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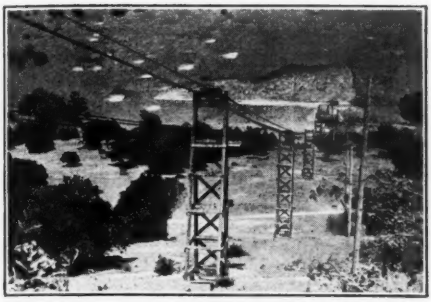

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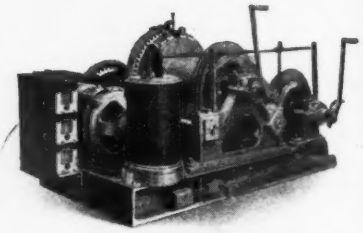

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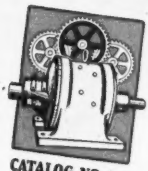

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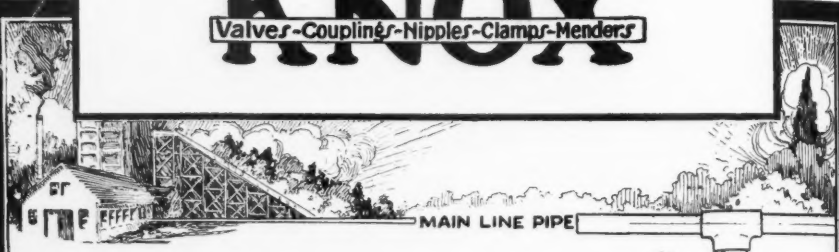

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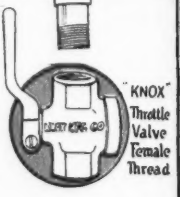

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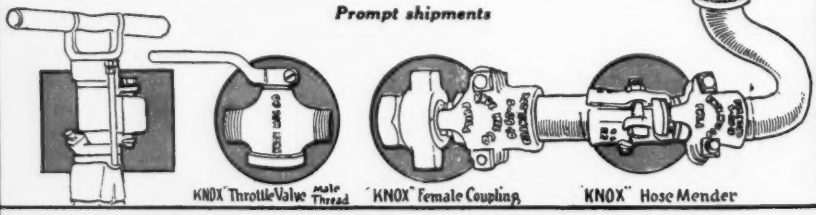

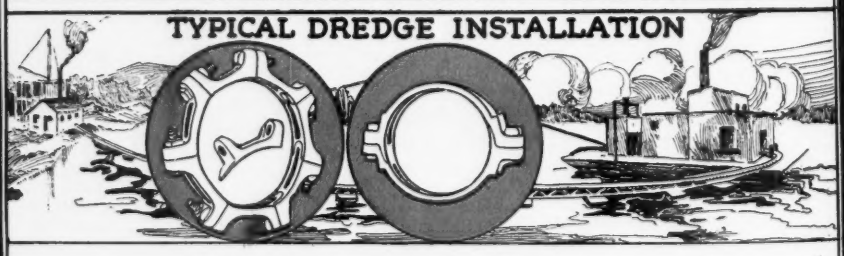

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